



## Future Hunting

A Globetrotting Search for the year 2051 Today

with Intel's Futurist Brian David Johnson

**Brian David Johnson is an Intel future hunter. He travels the world to find out what people are doing and how they are using technology. He then gathers his findings, collates it with Intel research and develops a unique and intriguing view of where we are headed. In this, the 40<sup>th</sup> anniversary year of the microprocessor, he globe trotted around the world to see if he could discover how we would be living 40 years into the future. And what he discovered was truly surprising.**

I was sitting shoulder to shoulder in the packed audience of a Bollywood musical comedy show. Men in white short sleeve shirts and women in traditional Hindi dress surrounded me. It was crazy hot. The lavish studio was decked out like a gigantic circus sideshow. The stage was crowded with nine foot tall horse heads, and go-go dancers in glittering silver costumes milled around the stage waiting for their cue to begin. The walls were draped in rich scarlet velvet, gathered in deep folds around massive clown heads with immense red balls on their noses. Atul, my new friend and guide, who had worked so hard to get me this far backstage had disappeared. He had said something like: "I think they think you want to be in the audience. Not in the future...in the *audience*." I didn't understand but to be polite I nodded and he left.



*The outside of the dazzling studio in Mumbai Photo: BDJ*

Now, when the band started to play and the shimmering go-go dancers started their routine I realized that I could be in deep trouble. I didn't know where I was in Mumbai, I didn't speak Hindi and no one knew I was here. I was literally lost in Bollywood. You might ask how I got myself in this situation. Well, that would be an excellent question. The answer, that takes a little explaining...

I am Intel's futurist. It's my job to have a vision for how people will experience technology ten to fifteen years from now. This might sound like science fiction but it's actually quite pragmatic. The design, planning and production of our technology can sometimes take five to ten years. So it is of vital business importance today that Intel has a deep understanding of the future.

The process I use to do this is called futurecasting. I don't predict the future. Futurecasting is a framework to develop a vision for the future and then a way to figure out what we need to do to build it. Prediction is a fool's game. Futurecasting allows us to develop an actionable vision for the future and then make it better.

In 1993 the science fiction writer William Gibson said: "The future is already here — it's just not very evenly distributed." I agree with Gibson. Actually I go one step further. I actually search out and hunt down the future today as a part of my futurecasting work. I travel all over the world looking for models and examples of the future today. Along with our social science, technical research and trend analysis, this futurehunting allows us to create detailed models for how people will act and interact with technology ten to fifteen years from now.

So why was I backstage on a Bollywood musical comedy set deep in the production districts of Mumbai? I was futurehunting! I hunt down subtle behavior shifts and minute examples of the future today that as Gibson said are *poorly distributed*. They're not always easy to find but if you talk to enough people and let your vision guide you, you can find them.

In 1980 the most famous futurist of them all, Alvin Toffler, observed in his book *Third Wave* that: "Giant historical shifts are sometimes symbolized by minute changes in everyday behavior." These minute and small shifts can give us examples for massive future changes. Keeping an eye out for these changes can help us clarify our vision for what the future could look like. But more important, it gives us the opportunity to ask the question: *Is this the future we want?* We can ask ourselves: *What kind of future do we want to live in?*

I'd like to tell you about what I've seen this last year. It seems appropriate that on this 40<sup>th</sup> anniversary of the microprocessor we can start futurehunting examples of what our next 40 years and what the next generation of microprocessors and computing might look like. So if you're ready... let's go!

## **Stockholm**

It was crazy cold in Stockholm. When I left Mumbai at 3am it had been over 90 degrees. Landing at Arlanda Airport outside of Stockholm the temperature had dropped to 18 degrees. The sky a brilliant blue and in the morning sunlight the magnificent city seemed to be just warming to the idea that spring was close at hand.

I had come to Stockholm to talk with Per Bjorkman, the head of distribution for SVT, Sweden's public broadcaster. SVT are an incredibly powerful broadcaster and player in the media landscape of Sweden. This power sometimes dwarfs the private firms. One of these private broadcasters told me that when SVT makes a move we all have to follow or die.

In 2007 SVT made the decision to digitize the entire television cultural history of Sweden. When I arrived to chat with Per they had completed the project. With great Nordic enthusiasm he showed me

the server in the basement. "The entire cultural history of Sweden here on a 5 PETA byte server," he said with unabashed joy showing me the servers.

Most forecasts show that the kinds of servers that Per and SVT are using will only grow over the next 40 years. The research firm Thug Interactive projected in their 2011 *Futurecasting Future Device Usage* that over the next ten years alone the growth in computational power in servers, sometimes called *The Cloud* and also referred to as *Big Data*, could grow 499%. But I wanted to ask a question: *Now that SVT had gone through the considerable task of digitizing all this information... well... now what?*



*Downtown Stockholm Photo: BDJ*

As a model for where this might lead us in the next 40 years and what this might mean for the next generation of chips I find this fascinating. For years in the high tech world we believed if we could just digitize all the world's content onto a server connected to the Internet then all our problems would be solved. We would have TV and entertainment on demand all over the world. It would all be perfect. But this, of course, is not true at all.

Now that SVT had captured the cultural history of Sweden they needed to contend with a complex web of legal agreements and digital rights. Even if they worked out the business and legal complexities there were network and infrastructure issues to deal with. Just moving all that information from server to server in the data center taxes the very materials we use in our wires. Copper cannot move that much data around at speeds that are needed to meet a truly on-demand entertainment world. It's SVT's mission to do public good but Per couldn't even deliver a TV show to every house in Sweden if he wanted to. Heck he couldn't even do it to every house in Stockholm. The digital infrastructure would break.

OK – time to get geeky for a second. In this world of massive media files whizzing around, we're going to need a more sophisticated approach to computational power. We can use multi-core and many-core processing depending on the type of computation or tasks that need to get done. Instead of copper what if we could use light to move around all those TV shows? A fiber connection between servers with incredibly fast transfer speeds would open up an entirely new range of possibilities.

But I didn't want to step there. SVT got me questioning the human and cultural implications of what they had done. What was the affect of it? How would people experience this new world? How do you find something to watch when the entire history of TV has been digitized? How do you even begin to search it? Beyond just watching TV, I started to ask what the implications would be for something like education.

To find out I called an American high school teacher and told him what I had found. I asked him what that would mean for how he taught his students. He paused, took a breather and then said: "It changes everything. If I had the entire cultural history of America right there before me. If my students had access to it. Then I would have to change how I teach. A lot of education today is predicated on the idea that I know more than my students. But if they can literally search everything then I think what I'm teaching is fundamentally different."

## **Rio**

The future is literally being built in Rio. The Museum of Tomorrow is being built on Pier Maua in Rio de Janeiro. Their mission is to present a living future; never becoming a museum of the past. I came to Rio to join a collection of international futurists from biology, cosmology and technology (me) to envision a *living future*.



*Overlooking the famous Ipanema Beach in Rio Photo:BDJ*

At the conference I met Andrew Hessel. Andrew is a synthetic biologist who is actually working to cure cancer. When he's not advocating for this admirable goal, he's trying to get people to see the future of synthetic biology

Synthetic Biology or *synbio* as it is called is the science of trying to understand the software of life. This is how Andrew explains what he does: *Imagine that DNA is the software and a single cell*

*organism is the hardware. You write and print your program with a protein printer and then load it into the hardware to perform the task.*

"It's like a smartphone and an app," he explained as we sat overlooking the legendary Ipanema Beach. "Imagine writing an app but that app is DNA. Then you load that app into the cell (he smiled) the smartphone. If it's a GPS app and you load it onto your smartphone then just like that your phone is now a GPS. But here's the thing that's really interesting; you have to remember that we are talking about living organisms. So when you load that GPS on to your smartphone, it becomes a GPS device. But now imagine that you go to bed and wake up the next morning and now you have two smartphone. You have two GPS. They are cells, they are living things and they multiply. By lunch time you will have four GPS. These are self-replicating computational systems."

But how do we program all these little computational systems? As we look 40 years out and prepare the servers and workstations we'll need, I imagine the amount of information that makes up our genetic code. How do we write that code? Taking a cue from traditional software programming: What are the compilers we need to enable metabolic architects to write the code of life at a high level? How do we make tools so that anyone can do this programming just like anyone can make a web site now?

And the things that we could create! We could program and modify grass seed so that when it is planted in a soil and detects minute traces of explosive, the grass would turn from green to red. Now imagine all we have to do is plant this grass seed in potential mine fields all over the world and we could find deadly landmines without having to risk human life.

Andrew told me about a group of students who he met that came up with a truly silly and genius application for synbio. These students reprogrammed E coli bacteria; this is the bacteria in your stomach. It's known as gut flora. These students reprogrammed the E coli so that when you digested food your poo would smell like peppermint.

"You know it's interesting," Andrew told me after we had moved outside sitting by the rolling surf of the Southern Atlantic. "The people who are really good at writing these high level functions, the ones who really understand how to synthesize all of this and build something—they are all 19 years old. They are the ones who get it. They are the ones we need to make the tools for!"

## **Tokyo**

Over the years I've gotten pretty good at making my way across crowded tradeshow floors. I've navigated through a hundred and seventy thousand comic book fans rushing to catch a glimpse of the legendary Stan Lee. I've bobbed and weaved my way through the crush of popiratzizi surging to snap a picture of the latest Hollywood star at the Consumer Electronics Show in Las Vegas Nevada. So as I made my way across the floor one day in Japan I was feeling pretty confident. But there were two problems. First, I was late and second, I was lost.

"I'm almost there," I said to Marty my always patient business colleague from Intel. He was waiting for me with an important customer. Let's just say it was a large consumer electronics manufacturer based in Japan.

"Where are you?" Marty asked.

"Well..." I paused, flipping my shoulders to the side and slipping between two businessmen. I often felt

like a football player at these times. “Well, to tell you the truth, I’m not really sure. I’m sorry Marty.”

“No worries,” he remained calm. “Tell me what you see.”

“A lot of people.” I cut through a rather large and rather empty booth. The woman behind the reception desk watched my maneuver with an expressionless face.

“No really, tell me what you see.”

“OK,” I started to look around but was pretty sure I was moving in the right direction. “There’s a tricked-out car with music blaring out of the back.”

“OK – you are close.” Marty replied.

“I can see some bathrooms on the far wall.”

“Good.”

“Oh, I see a pretty big crowd.” Always curious, I moved towards the crowd.

“What are they looking at?” Marty asked.

“Not sure,” I ziggled and zagged. “Oh I see. I’m walking past a stage with a robot carrying a smiling woman.”

“You’re close!” Marty yelled.

...and that to me is Tokyo.

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Computation is not just for computers anymore. Computation has found its way into our pockets, into our TVs, into our cars and even into the walls of our homes. People have become comfortable with computation spreading throughout their lives. The global research firm iHS projects in their 2011 *Futurecast 2021* that by just 2021 there will be nearly seven billion small computational devices throughout our lives. As a culture we have become comfortable carrying around computation in our pockets. We are becoming more comfortable with computational devices that carry us around (cars). Over the next 40 years we’ll more become comfortable with computational devices that carry themselves around: robots. When you think of it that way we can see robots simply as computational devices; nothing more than laptops with legs.

But what’s interesting about robots is that because they can carry themselves around, they become social actors in our lives. We develop an emotional connection to them. Japan has always been a pioneer in the field of robotics. That’s why I barely batted an eye when I saw a six foot robot carrying an adult woman. But over the next 40 years we’ll see this spread around the world.

If we think about robots as laptops with legs then I’ve started to wonder: *How do we program them?* If these computational devices become part of the social fabric of our lives can we think about software programming in the same way that we have for the last 40 years? Will the next 40 years see a new approach to programming? Will we even see a new form of UI or user interaction with these machines? Today it is quite natural to use gesture, touch and voice to interact with our gaming consoles, smartphones and cars. What happens when emotions and relationships become a new way of interacting and programming our new robots friends? What does it mean when simply living with a computer means you are programming it to better understand you?

Over the last 40 years we have seen social networking become not only possible but incredibly important for how we interact with our computational devices and our friends and family.

The sharing of location, sensor data and information has greatly improved how we navigate and show and even find something to eat. What happens when our robot friends need to talk to each other? What would a facebook for robots look like? And would your robot befriend you?

## **Mumbai**

If you remember back to the start of our world tour, we were in Bollywood and I was lost in a musical comedy show audience. Well, I'm happy to report I did make it out of Mumbai, but not before I learned something fascinating about the future.

I had come to attend the FICCI Frames conference. FICCI is like the Oscars, Cannes, CES and a massive music festival all at the same time. I came to Mumbai to see what Bollywood had in store for the future. I had no idea what I'd find.



*Outside Yash Chopra's Studio in Mumbai Photo: BDJ*

Overlooking the dazzling metropolis of people the sprawling Renaissance Powai Hotel played host to the conference. The tag line was, "A Vision for the next Decade." I was in the right place. I saw the winner of Indian idol and had a long conversation with the legendary Yash Chopra. Yash is the American equivalent of Steven Spielberg but much more popular. He's had a film playing in Mumbai for fifteen years straight. Imagine if *Schindler's List* were still playing at your local multiplex to sell out crowds.

Yash and Bollywood know how to put on a show. And that show is incredibly important to people. It isn't just a way to kill time. These movies and stories and entertainment feed the soul. It is the soul of India. Bollywood and entertainment has and will continue to drive the adoption of new technologies. We have seen it with movie theaters, TVs, and DVD players. People want their entertainment, their stories on their screens.

So what does this mean for 2051? Connections. Connectivity. Indian is massive and complex. Talking with government officials it became obvious that laying fiber or other *in ground* infrastructure

would be nearly impossible. So how do we get this entertainment to the people who can't live without it? The buzz at the FICCI frames conference this year was 3G and 4G. It started to become clear to me that the future really is not evenly distributed. The future of entertainment in Stockholm will be delivered on the back of an entirely different data infrastructure than in Mumbai. People will still want access the entertainment they love. They will still want to connect with the people they love but *how* they connect will be wildly different as we move to 2051.

Let's get geeky again. The servers and networks that provide the next 40 years of data, movies and communication are going to need to be a lot more intelligent. We will begin to networks and servers and cellular towers that are aware of the data that they are sent to our homes, handsets and cars. We need to understand that how we handle email and simple data and voice traffic is wildly different than that of video. The very nature of how we judge the quality of that connection will need to be redefined. As computation makes its way into the pockets of the world and into the hearts and homes in the form of our own robotic friends, how do we start to rethink how we program these devices? How do we re-imagine how they are powered? What will it mean when we are surrounded by intelligence?

### **Coming Back Home to the Lab**

After a year, this year, of *futurehunting* I'm now back home. The examples of the future that I've seen and the people I've talked to all contribute to the futurecasting models that I build. The goal of my work is to come up with an actionable vision for the future of computing so that we can build it. I combine the stories and interviews I've collected with the global ethnographic research conducted over the last fifteen years by our trained social scientists. This is then influenced by the technical research and computer science that goes on every day inside the walls of Intel. I am continually amazed by the intelligence and tenacity of our engineers. All of this is then tempered by long-term economic forecasts, projected population growth as well as other data points that you might expect: global broadband roll out, the deployment of 3G, 4G, WiFi and WiMax connectivity as well as industry supply chain projections. It's a lot of data but that's ok... we love data.

Ultimately it's our job to deliver these models for how people will act and interact with technology to the various technical teams around Intel. As I write this we are currently working on the 2019 CPU. We provide the requirements to the silicon architects so that they can understand the capabilities needed to develop technologies that will capture the imagination of consumers and make their lives better.

### **Santa Clara**

As we begin to wrap up, let's go back in time for a moment. Imagine that you are in California and it's 1971. You're working with Ted Hoff and team and you've just powered on the 4004 microchip. Naturally you and the rest of the team are pretty happy. You're excited because you've just developed an entire computer on a chip, unfortunately the Japanese calculator company you designed it for is about to go out of business. Undaunted you take out an ad in Electronic News that says: "Announcing a new era of integrated electronics: A microprogrammable computer on a chip." And you sell the first microprocessor for around \$60.

I have a question. As you celebrate, listening to the #1 song in the land Cher's *Gypsies, Tramps and Thieves* are you celebrating the fact that you have just changed the world? Or are you happy because you have just invented a piece of technology that will change the economic and geopolitical face of the planet? Do you realize that you have bettered the lives of billions of people? No... to be honest you have just built a better calculator and that is awesome!

We cannot forget to let ourselves be surprised by innovation. We can't forget to be open to that silly idea that turns out to be brilliant and changes the world. These ideas will come increasingly from all over the world. Each year new innovators are born. I have been to universities all over the world and I have to say that I'm impressed. I am wonderfully surprised with the passion and scientific power of our students. The future is theirs. Let them surprise us.

That is truly my prediction for the next 40 years of computing—we will continue to be surprised and it will be awesome.

Brian David Johnson

Berlin, Germany

*(Written on a smartphone)*