

**Frank Beckman:** Now let me introduce you to someone else who has a most interesting career. John Hagel is the co-chairman of the Center for the Edge, at Deloitte. But what I want to be is him thirty two years ago because he was the Chief Strategy Officer at Atari. The game company which at the time was the game company to be had. You had to have an Atari system back then.

**John Hagel:** Yeah. Next to Coca-Cola was the most known brand in the world.

**Frank Beckman:** So what happened to Atari?

**John Hagel:** Unfortunately, although it had a lot of brilliant people, they became much too complacent about their success and they wouldn't look at the edge, as you will, to see the potential challengers coming in until it was too late and unfortunately as they say - the rest is history.

**Frank Beckman:** Well the challenges are not just the other companies doing video games right?

**John Hagel:** Right. No, one of the big areas had a blind spot on although they were early entrance into was the personal computers. They had one of the first successful commercial personal computers.

**Frank Beckman:** What was it, the Atari 3600 or something?

**John Hagel:** Oh no, the Atari 800 and the 600 and 800, I think.

**Frank Beckman:** Well I know there was a 100 there somewhere. But in any rate, there is a lesson to be learned in what happen thirty years ago in that part of the tech industry that applies even today to what we are talking about with mobility and your team that is called The Edge.

**John Hagel:** Yes that is one of the reasons we call ourselves the Center for the Edge, is basically, to help companies focus on edges that today is likely to be dismissed and just say that's a distraction. And sometimes, it is, I mean there are a lot of fades on the edges but sometimes the edges are the entry points for a major new challenger.

**Frank Beckman:** So what is the edge exactly John? Explain that to our audience. How do you define it to your staff, your think tank people?

**John Hagel:** Yeah so thier charter for the organization is identifying emerging business opportunities that should by on the CEOs agenda, and to do the research to persuade them to put on the agenda. Our belief is those emerging business opportunities typically emerge first on some kind of edge and it could be demographic edges; younger generations coming into workforce so the marketplace. It could be geographic edges; emerging economy; the spawn new innovations and it could be technology edges, so there are many different types of edges but there is typically spawning grounds for what's next.

**Frank Beckman:** But there is sort of like watching for the tide coming further up on the shore and as that creeps closer to your property, that edge is drawing near and it's a threat to you.

**John Hagel:** Yeah and it is understanding the forces at work to say again, is this some kind of fade that is going away in a couple of years or is it the beginning of something that's going to change everything.

**Frank Beckman:** It's impossible to go into everything that is happening in the auto industry right now and into the technology that is tied to that. But what are the key areas on which you are focused in watching the edges? Where are the edges here in this new autonomous vehicle world?

**John Hagel:** There are a lot of edges, I mean clearly there are a lot of interesting technology innovations coming into the marketplace around autonomous vehicles, as you mentioned. The whole internet of things, which is related to autonomous vehicles helping them, as we call it, make the invisible visible. There are the analytics; the artificial intelligence that is required to make sense out of all this data. The technologies are evolving in an extraordinary rapid rate and the challenge and the opportunity we see for companies is how do you contact these technologies more effectively rather than just getting consumed with it's all about artificial intelligence or it's all about you know cloud computing.

**Frank Beckman:** Fascinating stuff and what we are seeing now could be the Atari ten years from now towards a PS4 or Xbox Live, who knows.

**John Hagel:** That's it.

**Frank Beckman:** We shall see. Thanks John fascinating stuff.

**John Hagel:** Absolutely, thank you.

**Frank Beckman:** So looking at auto mobility takes a different turn now as we go to Washington and Michael Berube is with us, Vehicle Technology Officer with the US Department of Energy, And one of the areas that you know you are looking at in Washington is the impact of fuel consumption or on fuel consumption of all of these autonomous vehicles we have been talking so much about. Have any conclusions been drawn yet or is this still in infancy?

**Michael Berube:** I think it is a little bit of both there. It is clearly at its infancy but it is moving very fast. We just recently completed a major study looking at just this question. What will the energy efficiency impacts be and that data came back and said on the positive side there could be up to a 60% reduction in energy use because of new mobility changes. But on the flip side, there is the risk to be up to 200% increase in energy usage. If you think all the good work that has been done in fuel economy and other things, imagine if there is a 200% increase in energy consumption as a result of new mobility changes - that would be pretty dramatic.

**Frank Beckman:** Well people in Virginia might be happy. They might get their coal job back again, but you're right, that is something you always think about is, well the cars won't be using as much gasoline more electric, but there is the need to power that vehicle somehow. That power has to come from someplace.

**Michael Berube:** Oh no, absolutely. I think that one of the big stories here is that with the changes happening and that are forecasting that are happening if we go to highly connected autonomous cars it may change the whole economics that make some technologies, like electric vehicles and fuel cells, more affordable, more rational. When you have vehicles that have been utilized at a much higher rate than today, you end up having a technology that may be a little bit more expensive like those today become more realistic to us and that could be a good benefit.

**Frank Beckman:** Do we know the impact Washington is going to have on all of these changes we are witnessing right now, with the changes in administration coming in just a few weeks?

**Michael Berube:** Well it remains to be seen. Certainly, I think one of the things we can say from the Department of Energy's prospective is we are not a regulatory agency. We are engaged in research and development to try to significantly improve the energy efficiency of transportation; reduce cost for consumers and I think that is something that is widely supported and agreed upon and...

**Frank Beckman:** Well both parties want that. They want input; they want advice; they want knowledge.

**Michael Berube:** And I think that we are well positioned to provide the data; the research; the work we have done in reducing the cost of batteries has been a significant factor so far and I think there a lot of work we can do to help understand how do we reduce congestions; how do you provide more mobility services to people that are currently under served but yet have it be in a more efficient way.

**Frank Beckman:** Let me close on batteries, Michael. Because what are the things that puzzled me and all the advances that we have seen in technology and smaller batteries and charges them in the like, it hasn't been that difficult to make them last longer. Why is it so difficult to advance that to the automobile and the bigger batteries and the heavier product if you will, that needs that power? Why can't we make more further advances so that are car can go three, four, five hundred miles on a charge?

**Michael Berube:** Well, we actually, I think you're just starting right now, literally in the market, to see those advances happening and it going to continue. It takes two or three years to go from the lab to the product. But we have reduced the cost of batteries from over \$1,000 to kill one hour to \$250 and the research that we are currently doing has a goal by 2022 to bring in down to \$125, cut it in half again. What we are doing with these batteries, we think about these electric cars, they have been out there now ten years, they are lasting. So in the range of now having 230+ miles you will see 300 miles range vehicles so at that point when we get the cost down and the mileage up like that; we are starting to focus on faster charging that's the key. That is the next key.

**Frank Beckman:** If I could go to a gas station and pump in my 87 octane gas in five minutes or three minutes whatever it takes and yet I get over night with the electric vehicle, guess what I'm more likely to get the gas car right.

**Michael Berube:** Absolutely. Our goal is to try to get that down you know initially thirty minutes down to fifteen minutes, there is going to be a big big increase in autonomous vehicles and infrastructure we see coming over the next four to five years. You will be start seeing to... just announced by the Department of Transportation; where you can drive across the country on an electric vehicle. It's not as full as you'd like it to be and it's not where gasoline stations are but that's going to grow as the economics become better.

**Frank Beckman** Michael ,thanks for coming by.

**Michael Berube:** Thank you very much.

**Frank Beckman:** Michael Berube from the Department of Energy.