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Schneier on Security

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The Internet of Things Will Be the World's Biggest Robot

The Internet of Things is the name given to the computerization of everything in our lives. Already you can buy Internet-enabled thermostats, light bulbs, refrigerators, and cars. Soon everything will be on the Internet: the things we own, the things we interact with in public, autonomous things that interact with each other.

These "things" will have two separate parts. One part will be sensors that collect data about us and our environment. Already our smartphones know our location and, with their onboard accelerometers, track our movements. Things like our thermostats and light bulbs will know who is in the room. Internet-enabled street and highway sensors will know how many people are out and about -- and eventually who they are. Sensors will collect environmental data from all over the world.

The other part will be actuators. They'll affect our environment. Our smart thermostats aren't collecting information about ambient temperature and who's in the room for nothing; they set the temperature accordingly. Phones already know our location, and send that information back to Google Maps and Waze to determine where traffic congestion is; when they're linked to driverless cars, they'll automatically route us around that congestion. Amazon already wants autonomous drones to deliver packages. The Internet of Things will increasingly perform actions for us and in our name.

Increasingly, human intervention will be unnecessary. The sensors will collect data. The system's smarts will interpret the data and figure out what to do. And the actuators will do things in our world. You can think of the sensors as the eyes and ears of the Internet, the actuators as the hands and feet of the Internet, and the stuff in the middle as the brain. This makes the future clearer. The Internet now senses, thinks, and acts.

We're building a world-sized robot, and we don't even realize it.

I've started calling this robot the World-Sized Web.

The World-Sized Web -- can I call it WSW? -- is more than just the Internet of Things. Much of the WSW's brains will be in the cloud, on servers connected via cellular, Wi-Fi, or short-range data networks. It's mobile, of course, because many of these things will move around with us, like our smartphones. And it's persistent. You might be able to turn off small pieces of it here and there, but in the main the WSW will always be on, and always be there.

None of these technologies are new, but they're all becoming more prevalent. I believe that we're at the brink of a phase change around information and networks. The difference in degree will become a difference in kind. That's the robot that is the WSW.

This robot will increasingly be autonomous, at first simply and increasingly using the capabilities of artificial intelligence. Drones with sensors will fly to places that the WSW needs to collect data. Vehicles with actuators will drive to places that the WSW needs to affect. Other parts of the robots will "decide" where to go, what data to collect, and what to do.

We're already seeing this kind of thing in warfare; drones are surveilling the battlefield and firing weapons at targets. Humans are still in the loop, but how long will that last? And when both the data collection and resultant actions are more benign than a missile strike, autonomy will be an easier sell.

By and large, the WSW will be a benign robot. It will collect data and do things in our interests; that's why we're building it. But it will change our society in ways we can't predict, some of them good and some of them bad. It will maximize profits for the people who control the components. It will enable totalitarian governments. It will empower criminals and hackers in new and different ways. It will cause power balances to shift and societies to change.

These changes are inherently unpredictable, because they're based on the emergent properties of these new technologies interacting with each other, us, and the world. In general, it's easy to predict technological changes due to scientific advances, but much harder to predict social changes due to those technological changes. For example, it was easy to predict that better engines would mean that cars could go faster. It was much harder to predict that the result would be a demographic shift into suburbs. Driverless cars and smart roads will again transform our cities in new ways, as will autonomous drones, cheap and ubiquitous environmental sensors, and a network that can anticipate our needs.

Maybe the WSW is more like an organism. It won't have a single mind. Parts of it will be controlled by large corporations and governments. Small parts of it will be controlled by us. But writ large its behavior will be unpredictable, the result of millions of tiny goals and billions of interactions between parts of itself.

We need to start thinking seriously about our new world-spanning robot. The market will not sort this out all by itself. By nature, it is short-term and profit-motivated -- and these issues require broader thinking. University of Washington law professor Ryan Calo has proposed a Federal Robotics

Commission as a place where robotics expertise and advice can be centralized within the government. Japan and Korea are already moving in this direction.

Speaking as someone with a healthy skepticism for another government agency, I think we need to go further. We need to create agency, a Department of Technology Policy, that can deal with the WSW in all its complexities. It needs the power to aggregate expertise and advice other agencies, and probably the authority to regulate when appropriate. We can argue the details, but there is no existing government entity that has the either the expertise or authority to tackle something this broad and far reaching. And the question is not about whether government will start regulating these technologies, it's about how smart they'll be when they do it.

The WSW is being built right now, without anyone noticing, and it'll be here before we know it. Whatever changes it means for society, we don't want it to take us by surprise.

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http://www.forbes.com/sites/bruceschneier/2016/02/...

Ryan Calo on the Federal Robotics Commission:
http://papers.ssrn.com/sol3/papers.cfm?...

Japan and Korea:
http://japan.kantei.go.jp/97_abe/actions/201505/...
http://www.roboticsbusinessreview.com/article/...

Kevin Kelly has also thought along these lines, calling the robot "Holos."
http://longnow.org/seminars/02014/nov/12/...

Commentary:
https://resilient.com/...
