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## CHAPTER 12

### INTERVIEW WITH TIM BERNERS-LEE

#### HARRY HALPIN AND ALEXANDRE MONNIN

Harry Halpin: How did the idea of philosophical engineering come about?<sup>1</sup>

Tim Berners-Lee: The phrase came about when we were originally discussing the idea of Web Science,<sup>2</sup> and I was tickled by the fact that when you study and take exams in physics at Oxford, formally the subject is actually not physics but experimental philosophy. I thought that was quite an interesting way of thinking about physics, a kind of philosophy that one does by “dropping things and seeing if they continue to drop”—in other words, “thinking about the stuff you do by dropping things.” Then this came up again when trying to explain to people that when we design Web protocols, we actually get a chance to define and create the way a new world works. It struck me what we ended up calling “Web Science” could have been called “philosophical engineering,” because effectively when you create a protocol you get the right to “play God” and define what words mean. You can define a philosophy, define a new world. So when people use your system—when they run the protocol—to a certain extent they have to leave their previous philosophy at the door. They have to join in and agree they will work with your system. So you can build systems—worlds—which have different properties. That’s exciting, and a source of responsibility as well.

<sup>1</sup> This is a transcript of an interview with Tim Berners-Lee done in Lyon by Harry Halpin and Alexandre Monnin in November 2010, edited for publication and published with permission of Tim Berners-Lee. We have added further comments in footnotes to explain some of the technical terms and background used in this interview by Tim Berners-Lee, who is widely acclaimed as the “inventor of the Web” because he wrote many of the fundamental protocols and created the original prototypes. The first use of term “philosophical engineering” by Berners-Lee in a public forum was this quote: “We are not analyzing a world, we are building it. We are not experimental philosophers, we are philosophical engineers” (Berners-Lee 2003).

<sup>2</sup> Web Science is defined as “a research agenda that targets the Web as a primary focus of attention” (Berners-Lee et al. 2006).

Harry Halpin: Would you consider the creation of Web standards to be an act of philosophy in progress?

Tim Berners-Lee: Certainly, when people write a specification, they argue about what words mean until everyone assumes that they mean in some sense the same thing. When the concepts in different people's brains have been sufficiently well aligned and there have been enough connections between the concepts, this is written down in a language that people feel comfortable with and that they share. You can, if you want to, philosophically argue that a word is in fact ambiguous, but nobody bothers. Understand that when you play the game [of Web protocols] you're not going to argue about that. For example, you're not going to pay a bill online, and then afterwards come back and say "Well, I sent some HTTP<sup>3</sup> headers off, but because they're just HTTP headers, they don't actually mean anything." As a spammer said once, "It's just a form field, I can put whatever I like there, it doesn't have to be the person sending the e-mail." But it does if you're playing the game! I think one of the things we're missing is the relationship between "the law of the land" and protocols. It should be easier to establish that when someone disobeys a protocol they've broken a kind of law via a straightforward path.

Harry Halpin: One of the most important aspects of natural language is that it's composed of words. In contrast, the Web is a space of URIs.<sup>4</sup> How is it that URIs and their meaning differs from other possible systems like natural language? What is special about URIs?

Tim Berners-Lee: There are many URI schemes, but one thing that is nifty about HTTP URIs is that they have domain names in them. So they're hierarchical, and a domain is something that one can own.<sup>5</sup> In the way the protocol works, the owner of the domain has the right to say—and the obligation to say on the Semantic Web!—what the things in that domain mean. It's not a question of philosophical discussions

<sup>3</sup> HTTP is the HyperText Transfer Protocol (Berners-Lee, Fielding, and Frystyk 1996), the primary protocol defined for use with the Web to deliver web pages through the Internet, although the protocol is now being used for many other applications.

<sup>4</sup> URIs (Uniform Resource Identifiers) are identifiers such as <http://www.example.org/page>, and are defined as an Internet Engineering Task Force Internet standard in various versions (Berners-Lee 1994; Berners-Lee, Fielding, and Masinter 2005). They have also been called Uniform Resource Locations (URLs) due to the debate over whether they "located" or "identified" resources (Berners-Lee, Fielding, and McCahill 1994).

<sup>5</sup> The domain name system refers to the "domain" in a URI. For example, in the URI, the domain is "example.org." The ownership rights of domain names can be purchased via domain registrars, who lease domains.

between third parties. If there's a dispute about what a URI stands for, then the way the protocol works is that you go to the person who owns the domain name, who typically delegates it to someone else, who has in turn designed an ontology that they store on a Web server. The great thing about the Web is that you can look up the HTTP URI in real time to get some machine-readable information about what it means straightaway.

Alexandre Monnin: Regarding names and URIs, a URI is not precisely a philosophical concept, it's an artifact. So you can own a URI, while you cannot own a philosophical name. The difference is entirely in this respect.

Tim Berners-Lee: For your definition of a philosophical name, you cannot own it. Maybe in your world—in your philosophy—you don't deal with names that are owned, but in the world we're talking about, names are owned. Some people have a philosophy where they find it useful to think of a name as just a function of use, not of definition. Other people like lawyers work in worlds where the model is that there is a legal definition of a term.<sup>6</sup> While meaning is use, use can be according to definition. So there are models, and now we're adding another one, in which meaning is defined by the owner of a name.

Harry Halpin: Wasn't it controversial that when the Web was first starting that everything could be named with a URI?

Tim Berners-Lee: At the IETF<sup>7</sup> certainly there was resistance. I originally called these things “Universal Document Identifiers” (UDIs) even before we started using them for concepts.<sup>8</sup> The IETF were a bit put off, thinking it was too much hubris to call them “universal.” Now I realize that I should have held firm and said “but they are,” as any alternative system of naming you can make out there, I can map it to the character set we use in URIs and I can invent a new scheme for it. So we can map any

<sup>6</sup> This is a reference to various debates over the “meaning” of URIs. Berners-Lee is likely referring to the defense of “meaning as use” by Yorick Wilks (Wilks 2008), Pat Hayes (Hayes and Halpin 2008), and others.

<sup>7</sup> The IETF is the Internet Engineering Task Force, the primary standardization body of the Internet since its inception. Tim Berners-Lee originally took the Web's primary standards such as HTML, HTTP, and URIs to the IETF, and the Web is considered only one of many possible applications that can run on top of the Internet. He later launched a Web standards body, the World Wide Web Consortium (W3C) in 1994.

<sup>8</sup> A draft called “Universal Document Identifiers” was announced in February 1992. See the message of Berners-Lee to the www-talk mailing list: <http://lists.w3.org/Archives/Public/www-talk/1992JanFeb/0024.html>.

scheme to URIs. We'd already mapped Gopher, FTP, and these sorts of things.<sup>9</sup> Now, we've got HTTP and there will be lots of other schemes. So in a sense URIs are universal, as we're saying anything—any name that you come across—can be mapped into this space. So yes, there was a lot of pushback against that, and hence the “uniform” rather than “universal” in URIs.<sup>10</sup>

Alexandre Monnin: Given the origins of philosophical engineering and Web Science, don't you think that Web Science is doing two things? The Web is an artifact, we produce it, we implement it, and as you said, we decide what the protocol means and how it should be used. On the other hand, Web Science is a science, so we make discoveries and we are also surprised by our own creation.

Tim Berners-Lee: The Web Science cycle<sup>11</sup> starts off with idea that the design of the Web is not just the design of one thing but the design of two things: a social and technological protocol. For example, in e-mail, there's a general technological protocol like SMTP<sup>12</sup> and there's a social protocol. In e-mail, the social protocol that states that everyone involved is ready to run a machine that has the space to store e-mail messages while they are en route to their destination, that people will send e-mail to each other on perfectly reasonable topics, and that people will read e-mail that they receive. There's that social piece of e-mail, but then technically e-mail is actually pushed around with SMTP and pulled off with IMAP, and those pieces then together form a system.<sup>13</sup> It's a microscopic system that explains how one person sends another person an e-mail through a finite number of hops, but then you get the effects of scale. So the engineering of Web Science is not like building a mousetrap. You design a microscopic system, but what you're interested in is the macroscopic phenomena that emerge. When you do the science—the analysis and the whole rest of the cycle—for e-mail, you look at what is happening and notice: Spam has happened, oh dear! What went wrong? One of our social assumptions was wrong, namely, that everybody is friendly and will only send e-mail to

<sup>9</sup> FTP is File Transfer Protocol, for transferring files over the Internet (Postel and Reynolds 1985), and Gopher is a pre-Web Internet protocol that was menu-based rather than hypertext-based (Anklesaria et al. 1993).

<sup>10</sup> Berners-Lee is referring to the transformation of URIs as “Universal Resource Identifiers” (Berners-Lee 1994) to “Uniform Resource Identifiers” (Berners-Lee, Fielding, and Masinter 2005) in the final IETF Internet standard.

<sup>11</sup> The “Web Science Cycle” is illustrated by Berners-Lee in his 2007 presentation “Web Science: The Process of Designing Things in a Very Large Space.” Available at <http://www.w3.org/2007/Talks/0509-www-keynote-tbl/>.

<sup>12</sup> SMTP is the Simple Mail Transfer Protocol, the heavily deployed IETF standard for delivering e-mail (Postel 1982).

<sup>13</sup> IMAP is the Internet Message Access Protocol, used by client software to modify (delete, send) e-mail stored on a server (Crispin 1994).

another person when the other person wants to read it. So the academic assumption is broken, and we have to redesign e-mail. Interestingly, no one has really succeeded in redesigning either the social or the technical piece of mail to make spam go away. So there's an example: there's a design piece and an analysis piece, an engineering piece and a science piece, with one being done on the microscopic system and the other being done on the macroscopic system, and we're missing a lot of the mathematics that would let us understand the connection between the two levels.

Harry Halpin: What is the role of philosophy in Web Science? Is there such a thing as a philosophy of the Web?

Tim Berners-Lee: An awful lot of philosophy in the past has been wasted, as it was done before we understood evolution. We were trying to understand emotions, and now we can point to evolution producing mammals with emotions. So a lot of philosophy in the past is inapplicable. A lot of people might say that philosophy is irrelevant to daily life, but if a W3C Working Group<sup>14</sup> stops and people start arguing about what things really mean—people refuse to play the game, refuse to say what terms mean, and they don't do their job to define a protocol properly—then it's a philosophical task to point out to them that this is important. Also, philosophy may be necessary to explain what happens when the legal system hits the Web. When you make a web-page you can link to anything, you can write anything about it. But when a lawyer comes along and reserves the right to charge you to link to their page, then in a way it's a philosophical question, as you have to tie linking to the way the protocol is defined over a name as just a reference, something that has never been controlled over the millennia.<sup>15</sup> Systems where you control names haven't worked so far, and so you need the philosophy to show how these protocols are grounded out in history and in concepts for using names that lawyers understand.

Alexandre Monnin: What do you expect from the philosophy of the Web?

Tim Berners-Lee: What I would like for philosophers to do is to work diligently and to produce very nice documents that describe to people like computer scientists how things work in a simple way. What happens when you click on a link? Quite a lot of that is philosophy. So, I'd like for you to have enough of a body of understanding that when people in a Working

<sup>14</sup> A Working Group is a group composed of a group of individuals that create Internet and Web standards at the IETF and W3C, respectively.

<sup>15</sup> There has been extensive discussion of the use of URIs as a means of reference versus a means of accessing web pages between engineers and artificial intelligence researchers (Hayes and Halpin 2008).

Group stop and say, “Wait, this doesn’t match what I learned from Wittgenstein” then you can say, “No, please go read this pamphlet, it’s about philosophical engineering and it explains the philosophy of what you’re doing, so you won’t find Wittgenstein very useful in this case or these are the bits that you will find useful.” So if you can produce enough discussion and understanding so that we don’t have to stop work for philosophical discussions and we can rely on philosophy being there, that would be excellent.

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