Remarks on Receiving a D.Sc. (*honoris causa*) from the National University of Ireland, December 1, 2011
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I am indeed humbled by this remarkable honor that for me is a career and lifetime event. I thank the National University of Ireland with heartfelt gratitude. I am also deeply honored to be considered in the company of my fellow honorees with whom it is hard for me to compare myself – with the depth of Irish culture and letters, the urgency and significance of diplomatic and United Nations affairs, and the significance of Irish labor relations. I interpret the generous citation by Dr. Jimmie Browne, president of NUI, Galway as recognizing the innovative and transformative power of technology, reflecting the foresight of Dr. Browne and NUI that technology is comparable in impact to culture, law, politics, and letters.

I am not sure that I deserve this honor. My contributions to the University are surpassed by what I have gained working with the Digital Enterprise Research Institute (DERI) at NUI, Galway that gave me a front row seat at one of the most remarkable developments of our time.

First and foremost I had the honor of working with innovative and spirited researchers at DERI, led by DERI's Director Prof. Stefan Decker, and at the university especially with NUI Galway President, Dr. Jim Browne who had the foresight to support DERI and this phenomenon called the Web. I would like to make a few remarks in praise of this courage and foresight even if Dr. Decker and Dr. Browne, and Science Foundation Ireland that has provided significant funding, could scarcely have imagined the value and impact of the amazing developments since 2003.

Now a little context: When I visit Galway I travel from Shannon through Ireland's bucolic, green, rolling hills dotted with stone cottages, farms, and fences, not unlike my rural Canadian roots. This beautiful and magical countryside is – for me - characteristic of Ireland's fabled culture and economy. My fondness for this is its warmth of childhood familiarity – a world that feels safe. I arrive in a very different world at DERI; NUI's research institute that contributes to technology innovation that in turn is re-inventing our world. I know that that sounds grand. Let me explain.

Since shortly after its inception in 2003 DERI has been regarded by leading experts including Sir Tim Berners-Lee who invented the Web, as one of the leading research institutes in the world of the Semantic Web. In DERI, NUI and Ireland has an innovative force that through technology is contributing to re-defining our world. This re-definition inherently involves disruption.

There is considerable evidence of the profound impacts of the Web and Internet on our world. An immediate example is the contribution of social media to the Arab Spring. My view is that the Web has accelerated the unleashing of natural forces – social, economic, cultural, political, academic, and others – that having escaped Pandora's box cannot be put back in.

The revolutionary overthrow of dictators is a little dramatic, so let's consider positive impacts such as economic growth that the world so urgently needs. McKinsey Global Institute estimates that "In rich countries the internet has generated as much as 10% of GDP growth over the past 15 years" and "accounts for over 20% of economic growth in mature countries over the past five years." Just as Twitter contributes to political disruption, as McKinsey notes, "The Internet will be a disruptive force resolutely shaping the economy and the 21st century."

These impacts are evident in the world's most powerful enterprises. In 2003 when DERI was created I could not have anticipated the following observation. While less than a decade old, the Four Horsemen of the Internet – Google, Apple, Facebook, and Amazon – have gone from mere ideas to the ranks of the world's most valuable enterprises, have disrupted entire industries, and are currently in a war to disrupt each other. They now wield more influence than the world's erstwhile largest enterprises – not only in retail, entertainment, publishing, and communications but in every domain. While business innovation –

the goods and services provided - is the battlefield, the weapons are technology – the Web, Internet, Cloud, social media, and Big Data – that have been at the heart of DERI's research for almost a decade. The world's largest enterprises must now compete directly with these powerful Four – and require the technology to do so. The predominant challenge is no longer innovating new businesses; but to develop a 21st century technology base with which to innovate and operate and more profoundly to transform themselves into a model pioneered by the Four. Technology-based innovation is creating remarkable value through innovation that leads, inevitably, to transformation.

It is unlikely that in 2003 Stefan Decker or Jimmie Browne could have anticipated the impacts of the Internet or of DERI's contribution to it, just as we cannot imagine their impact 5 or 10 years hence let alone one year from now. Every year for the past decade we – Internet and technology experts – have been amazed at these impacts – some planned, many unforeseen. My colleague Gérard Berry, at the French Academy of Science, observes that we will continue to be amazed until we understand these phenomena. This is at the heart of DERI's mission.

Consider the following positive and profound change – a fundamental transformation in scientific research from empirical to data-driven methods. These trends began in science before the Web but were dramatically accelerated by the Web and are now widely used not only in science and the humanities but in all research domains. Now in 2011 these technologies and methods are perceived as critical to business innovation. Perhaps due the billions of dollars involved, the most dramatic stories come from Wall Street where web-based, multi-disciplinary, data-driven analytics have replaced their less effective predecessors. Less dramatic but more compelling are remarkable results in biology, physics, chemistry, and medicine. A powerful story is the contribution of these methods to increasing the quality and the lower cost of healthcare delivery. The impacts of these innovative technologies in which DERI is a world leader, like most technical advances, can have profoundly positive outcomes while inevitably disrupting the status quo. Remarkably these technologies and methods, although they have a longer history, have emerged dramatically in the short space of a decade.

For most of that decade DERI has offered leadership in these technologies but also beyond technology. Web Science, in which DERI is a leading contributor, addresses the inherently multi-disciplinary nature of Internet-based opportunities and challenges. The potential and disruption of these technologies are broadly applicable to the World, to Ireland, and to NUI. So it is essential to understand not just the technologies but also their transformative power. NUI and Ireland have in DERI a world-leading institute with which to understand the issues of our increasingly digital world to achieve positive social, cultural, economic, and academic change. Going forward this requires foresight and courage to create value and to deal with the inevitable disruptions and more broadly to change how we think and act. That is exactly what Dr. Decker, Dr. Browne, NUI, and SFI did in 2003 in investing in DERI.

The potential and disruption of these technologies applies to academia. Consider these amazing facts. The University of Phoenix's current MBA class has 135,000 of their total 380,000 online student. Perhaps more compelling are world-leading universities like MIT and Stanford. Since 2001 MIT has placed its entire 2,000-course syllabus online for free. The world's leading lecturers and researchers teach Stanford's free online computer science classes. Enrollments this term include 66,000 in the Database course; 72,000 in Machine Learning; and 175,000 from 190 countries in Introduction to AI. Those courses do not yet give Stanford degrees but Stanford's five-year-old online High school does. Quantitative measures like worldwide enrollments may not be so amazing. Qualitative changes such as developing multi-disciplinary methods are far more challenging in our increasingly connected world challenges as simple as stasis. My experience addressing significant issues such as healthcare reform at the US National Academy of Science have proven beyond doubt that multi-disciplinary methods are essential. Many domains and constituencies must be considered individually and collectively to reform healthcare. Such considerations are central to Web Science that is at the heart of DERI's mission.

I conclude with the juxtaposition of comfortable bucolic Galway in contrast with our emerging Digital Universe that is unleashing natural forces that are re-defining our world and that emphasize the need to understand and harness these forces.

It has been extremely stimulating, enjoyable, and rewarding to have a front row seat observing DERI and NUI Galway take leadership in one of the most remarkable developments of our time.

Just as I am amazed at the impacts of technology, so am I amazed at having received this honor from the National University of Ireland for which I am deeply honored and sincerely grateful.

Thank you
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