Mapping the Future of the Internet onto Global Scenarios

A preliminary view

Heather Creech, Maja Andjelkovic,
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1.0   Introduction

1.1   A gap in sustainable development scenarios

There is growing recognition of the urgent need to reconcile economic growth with environmental sustainability and social development. All major global environmental trend reports show ongoing declines in the capacity of our ecosystems to support us and warn that we are close to crossing critical thresholds. Climate change, one of many consequences of this imbalance, is widely acknowledged to be one of the most critical global challenges of our time. Some countries and regions have experienced dramatic development, while others have remained mired in poverty. Currencies and economies have collapsed and been rebuilt and have collapsed again. All stakeholders—governments, the private sector, civil society—are increasingly deliberating on options for responding to these challenges. Thanks to the innovations of Shell, the Global Scenario Group (Tellus and Stockholm Environment Institutes), the United Nations Environment Programme and others, scenario-building and futures-forecasting techniques have become valuable tools for helping policy experts consider the decisions needed to advance the most desirable outcomes:

Scenarios are meant to provoke thinking not only about the future, but especially about *necessary and possible decisions in the present to advance the most desired scenario.*[1]

However, IISD has observed that consideration of the impact of the Internet and its associated technologies has been either absent or quite narrow in most sustainability scenarios. These scenarios have ranged from assuming the role of the Internet is neutral to viewing the technologies as a driver of globalization, albeit with a predominantly narrow focus on economic implications. Consequently, many scenario-building initiatives have failed to adequately consider how the Internet and related information and communications technologies (ICTs) are actually transforming institutions and governance, and impacting social development and environmental management. These scenarios fail to bring to the forefront of global governance challenges how the Internet/ICTs have an impact on issues such as privacy, security and trust of institutions. Policy decisions taken regarding Internet development, deployment, access and use can have significant positive and negative consequences in this broader context.

Absent in most global scenarios is any reference to how the evolution of the Internet might possibly restrict "the creativity, innovation, and flow of information"[2] and how changes in those information flows might impact sustainability. Decisions for a sustainable future that simply assume continued growth in Internet innovation and information flows may be significantly off the mark.

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[1] Philip Vergragt, Tellus Institute, 2008.
[2] Internet Corporation for Assigned Names and Numbers [ICANN] value statement.

1.2　The need to consider the future of the Internet

The impact of the emergence and evolution of the Internet on the world economy has been a central topic of discussion in many global economic forums over the last decade. The Digital Opportunity Task Force (DOT Force) created by the G8 heads of state in July 2000 was the first to rally the international community "to identify ways in which the digital revolution can benefit all the world's people."[3] International dialogue has since begun to consider the implications of the increasing importance of the Internet in all policy domains, and its potential as a powerful driver of innovation, sustainable economic growth and social well-being. The OECD Ministerial meeting on the future of the Internet economy in Seoul, Korea, June 17–18, 2008, considered recent "shifts in the use and functionality of the Internet"[4] and how these constitute a "major transition in the evolution of the Internet and the economic system that has developed around it." The meeting summary specifically highlights how such developments necessitate that relevant policy "be carefully crafted and co-ordinated across policy domains, borders and various stakeholder communities." The International Telecommunication Union (ITU) has hosted a symposium series to investigate the role that ICTs play in causing climate change, but also in monitoring, mitigating and adapting to climate change, with the aim of forwarding their findings for appropriate action at the next G8 Summit.

The mechanisms guiding the evolution of the Internet have also been the central focus for thousands who participate in the Internet Governance Forum (IGF) to consider the development and application of "shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the Internet."[5] The role of issues of openness, security, diversity, access and the governance of critical Internet resources on the evolution of the Internet have featured prominently in these global debates. However IISD and many other stakeholders at the IGF have voiced concern about how these policy discussions have been disconnected from a broader consideration of their implications for sustainable development.

Both global scenarios experts and the stakeholders at these global forums would benefit significantly from making this connection. The scenarios of the fourth Global Environment Outlook (GEO-4) hosted by UNEP merely acknowledged the growth of telecommunications and the Internet as having revolutionized communication patterns, however the implications for sustainable development within their framework remain unexplored. The Global Scenario Group (GSG) adopted the central premise that a global society is taking shape as a result of increasing global connectivity which is driving a planetary-scale transition of uncertain sustainability—but

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[3] Digital Opportunities for All: Meeting the Challenge Report of the Digital Opportunity Task Force (DOT Force), www.g7.utoronto.ca/summit/2001genoa/dotforce1.html

[4] The Future of the Internet Economy OECD Ministerial Meeting, www.oecd.org/site/0,3407,en_21571361_38415463_1_1_1_1_1,00.html

[5] WSIS Tunis Agenda for the Information Society, www.itu.int/wsis/docs2/tunis/off/6rev1.html.

they did not extend their projections to consider how different models of the evolution of the Internet might impact that transition.

The Shell Global Scenarios have given nuanced consideration to how market incentives, communities and state regulation "shape the evolution of the Internet and of the many processes for which it can serve as a foundation."[6] Izumi Aizu alluded in an interview with Shell to ways that Internet vulnerabilities such as spam "may take us into other scenarios." However, how such Internet development issues could lead to alternative outcomes was not reflected in Shell's summary commentary. An extension of this work holds great promise for policy-makers considering how to best to guide the evolution of the Internet in support of sustainability. Otherwise, critical implications may remain overlooked.

> "The Internet … is changing the power of individuals very much in an Open Doors perspective. But states have not said their last word, and commercial trends like spam call for solutions that may take us into other scenarios."
> **Izumi Aizu**
> *Shell Global Scenarios to 2025*

IISD further suggests that it is critical to consider how institutions are being altered as the Internet increasingly underpins key processes, and consequently impacts the very nature of globalization itself. In this context, threats to the future of the Internet, such as the possibility of bifurcation through changes in critical protocols (IPv4 vs. IPv6) and intensive firewalling by regimes, take on increasing significance. By extending the examination of Internet development issues to consider their role in these foundational changes, global scenarios experts would develop a more complete picture of the positive or negative impact that interventions in the evolution of the Internet may have on global sustainability. This would make a significant contribution to the evolution of global scenarios regarding the ultimate goal of sustainability.

1.3   Mapping Internet futures onto global scenarios: A trial run

IISD initiated a trial scenarios process that would build on global scenarios work that has been done so far, but would provide a more in-depth consideration of the full range of Internet development and deployment issues within a global scenarios framework.

The aim of this research is to establish a conceptual framework on how to think about the global future both in relation to sustainability and in relation to the critical Internet uncertainties. Our intention is to develop a language and a framework in which the relationships between future sustainability and the future of the Internet can be more systematically described and

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[6] "Shell Global Scenarios to 2025," Royal Dutch/Shell Group, Institute for International Economics, USA (2005).

investigated. In this way we hope to develop a better understanding of the relationships between sustainability and Internet governance, ultimately to enable stakeholders to discuss and to influence Internet governance in a direction that takes global sustainability as a challenge and as a context.

As a starting point, IISD invited the Tellus Institute to share with us the findings of the Global Scenario Group (GSG)—a set of six possible pathways that the world might follow. Based on our own research, we shared with Tellus the architecture of the global system of the Internet and its associated technologies and stakeholders, and the major critical uncertainties facing the development and deployment of the Internet. Through a series of three workshops, we began a process of envisioning what the Internet might look like in each of four major scenarios—and how the resolution of critical uncertainties might take the world in one direction or another.

1.3.1   Ottawa workshop, October 23–24, 2008

The Ottawa workshop was held in two parts. On the first day, the key issues were reviewed. IISD presented the critical Internet uncertainties, and the challenge of defining the Internet sector with all of its stakeholders. Tellus Institute presented the GSG scenarios. In the subsequent discussion we considered how to construct a matrix conceptualizing the interaction between the four main GSG scenarios and a grouping of five critical Internet uncertainties as developed by IISD.

On the second day, after refining the dimensions of the critical Internet uncertainties, IISD divided a panel of local Internet stakeholders into four breakout groups to each develop one of the four scenarios in a creative way, guided by the GSG scenarios and by the dimensions of the critical Internet uncertainties (see 6.0   Appendix: Participants List).

1.3.2   IGF workshop, December 3, 2008

A second workshop co-organized by IISD, Association for Progressive Communications (APC), Industry Canada and The Energy and Resources Institute (TERI), was held at the Internet Governance Forum (IGF) in Hyderabad, India. The workshop started with the problem statement: will global futures affect the development and deployment of the Internet; will development and deployment of the Internet affect global futures?

The workshop participants were then provided with an overview of scenarios, how they are used and examples of major global scenario processes (Shell, United Nations Environment Programme, and the Global Scenario Group). The participants were randomly divided into four breakout groups. However this time each group was provided with a brief description of one of the four stories of what the Internet might look like in the future, as developed during the Ottawa workshop.

Facilitators led the participants in each of the breakout groups to challenge the Ottawa workshop storylines by considering two questions:

1. What impact do you think global crises could have on the management of the Internet?
2. What will happen to your priority Internet concern in this future?

A volunteer from each of the groups reported back with a revised or enhanced story of what the Internet might look like. Four expert commentators (see 6.0   Appendix: Participants List) were then asked to reflect on the four Internet futures by considering whether they had heard something from one of the stories that either changed their thinking, or reinforced where they thought the Internet should go.

1.3.3   Diplo workshop, December 5, 2008

While at the Internet Governance Forum, IISD organized a third workshop for approximately 20 Diplo fellows attending the IGF, all successful participants from DIPLO's Internet Governance Capacity Building Programme, and primarily from developing countries.[7] This workshop followed the same format to that of the earlier IGF workshop, but ran for a longer time period than the previous two workshops. As before, a volunteer from each of the groups reported back with a revised or enhanced story of what the Internet might look like in their assigned future. This was followed by a group discussion and debate on the utility of each Internet story.

The following report provides a first glimpse of the intersection of major Internet uncertainties with possible trajectories for the future of the world. We begin with an overview of the "backdrop" scenarios from the Global Scenario Group, upon which we attempt to map the future of the Internet. This is followed with a brief review of the Global Connectivity System and the range of uncertainties that may affect its stability and security. Finally, we present the storylines that have emerged from the three workshops.

2.0 The Scenarios Process of the Global Scenario Group

The future of the world in terms of (un)sustainability has been researched in many ways, including by the scenario method as developed by the Global Scenario Group. In this method, possible global futures are developed by a combination of a forecasting method (business as usual) and a backcasting method (desirable futures); a third class of scenarios is a class of undesirable futures. In Section 3 we will describe these scenarios and their application in more detail.

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[7] See Diplo's Internet Governance Capacity Building Programme at www.diplomacy.edu/ig/.

Tellus Institute has been the main convener of the Global Scenario Group that developed a limited number of global scenarios. The main driver for the development of these scenarios was the wish for a better understanding of how a global "Great Transition" to a sustainable world could take place, and a more rigorous treatment of the various paths to get there.

Sustainability can be defined in many ways. Most well-known is the Brundtland definition of sustainable development: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition places human need fulfillment in the centre, and calls for intra-generational as well as inter-generational equity. Implicit in this definition is the conservation of resources and limitation of environmental pollution to "sustainable" levels. Sustainability means long-term prosperity and human need fulfillment, environmental stewardship and global equity.

Scenarios are stories about possible futures, and how to get there. The future is unknown and cannot be predicted or modelled. However, thinking about the future is not only possible but also desirable, because it enables us to act in the present in a way that anticipates possible and desirable long-term outcomes. There are two major classes of scenarios: forecasting and backcasting. Forecasting scenarios are essentially a continuation of trends in the present; by modelling the known interactions between driving forces, variations in outcomes will be achieved. Conceptually, however, it sees the world as a place where in essence the future will be more or less like the present. Not surprisingly, in such scenarios modelling the driving forces in the present world, and extrapolating them into the future play a major role.

In contrast, backcasting scenarios are led by a desirable picture of the future, and then asking how to get there. In such scenarios visions of a desirable future play a more important role than modelling. Future visions can be obtained in multiple ways, by brainstorming or envisioning exercises with multiple stakeholders, or by individuals using their creativity. Subsequently, modelling can then be used to understand and develop viable pathways of how to get there.

The Global Scenario Group has developed a set of scenarios using a combination of forecasting and backcasting tools. They developed three sets of scenarios that were modelled after dominant world views: Conventional Worlds, Barbarization and Great Transitions.

GSG scenarios
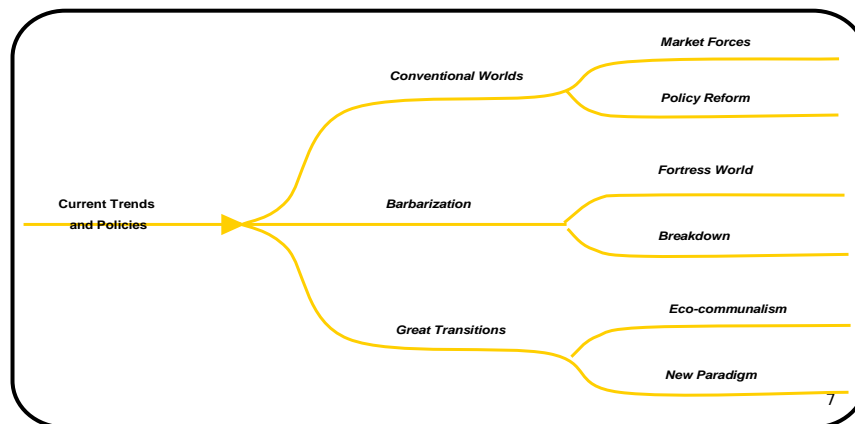
Conventional Worlds is a set of scenarios that in essence are extrapolations of the present world, including the forces of globalization and the convergence of the developing and the developed world in economic terms. This scenario has two variations: Market Forces and Policy Reform.

The **Market Forces** scenario is a forecasting scenario in which powerful actors advance economic growth through neo-liberal politics and largely unregulated markets, and by integrating developing countries into this modernization paradigm.

In contrast, the **Policy Reform** scenario is a backcasting scenario in which the vision of sustainable development is taken as a starting point, and in which strong government policies are developed to harmonize economic growth with a broad set of social and environmental goals. The strategic goals have been set by the 1992 Earth Summit and by the Brundtland report of 1987.

The **Barbarization** scenarios describe a world in which neither market forces, nor government policies, nor technological innovation have been able to contain social tensions and environmental breakdown. In this scenario the tensions created by population growth, economic development and increased consumption; unlimited exploitation of natural and human resources have created a series of crises that cannot be mastered by policies and institutions.

In this set of scenarios, the **Fortress World** scenario is a scenario in which powerful institutions protect the privileges of the rich and powerful elites by retreating to protective enclaves. Outside there is poverty and chaos.
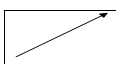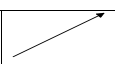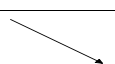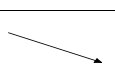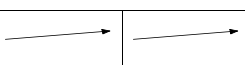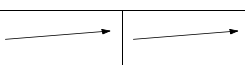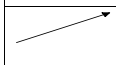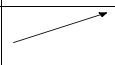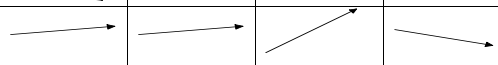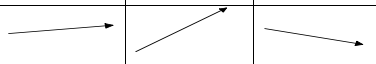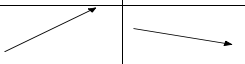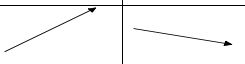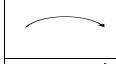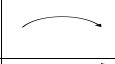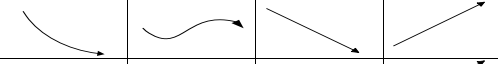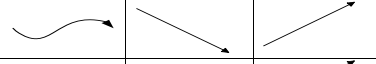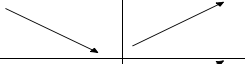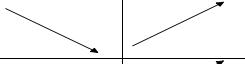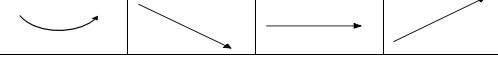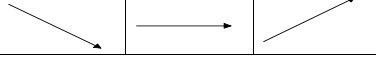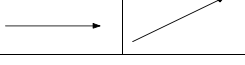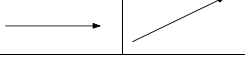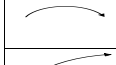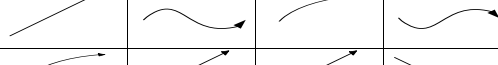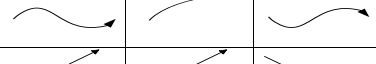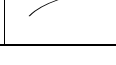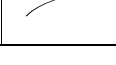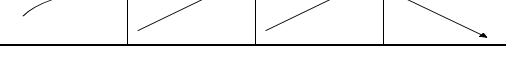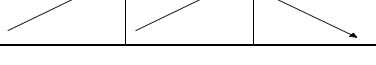
By contrast, in the **Breakdown** scenario there is a widespread collapse of security, finance and governance systems, resulting in economic depression, political instability and civil unrest.

The Great Transition scenarios describe systemic and transformative change across many societal dimensions, including production, technology and consumption. They imply a deep change in values like human solidarity, quality of life, respect for nature, and a change in lifestyles and consumption patterns. In this sense they are backcasting scenarios, describing visions of a sustainable world, and pathways how to get there.

Eco-communalism is a localized version which describes local chains of production and consumption, and an orientation on locally relevant lifestyles and values. Because it is hard to see how the present globalized world might retract into an eco-communalist world, one could assume that such a world would arise only after a Breakdown or a major global crisis.

New Sustainability Paradigm is based on the vision of globalization as an opportunity for forging new categories of consciousness, like global citizenship, sustainability, and the well-being of present and future generations. The driver may be a global citizens' movement.

Scenario Structure with Illustrative Patterns

The table above suggests what might happen in each of the scenarios with respect to major sustainability considerations: population growth; the economy; the environment; equity and poverty alleviation; technological advances in general; and conflict.

Recent events might suggest that the unregulated market forces scenario would not necessarily lead to sustained economic growth. Nevertheless, other posited trends (varying degrees of environmental degradation and poverty) are similar to those suggested in other scenarios exercises, such as UNEP's Global Environment Outlook Scenarios. The technology column of the GSG scenarios does not include a robust consideration of the Internet and global connectivity issues.

From the six scenarios presented by the GSG, we limited ourselves to four in our trial process: Market Forces, Policy Reform, Fortress World and the Great Transition (New Sustainability Paradigm) scenarios. These four scenarios are the most useful in the context of global Internet uncertainties. We considered at the outset that the Breakdown scenario is not useful for a critical analysis of how Internet issues connect with sustainable development, as the Breakdown scenario holds the least promise for sustainability. The Eco-communalism scenario has a low probability except as a possible aftermath of a Breakdown scenario.

3.0 The Global Connectivity System and Critical Internet Uncertainties

As a first step in mapping the future of the Internet, we needed to consider what constitutes "the Internet" and its stakeholders, and what would be the major, critical uncertainties about its future development and deployment.

Any study of the history of the Internet quickly sheds light on a system of interactions, influences and linkages between the ICT sector core (hardware, software, cables and signals) and a periphery of actors not normally considered a part of the traditional ICT sector that have played a critical role in shaping the evolution and use of the Internet. It is the actors across this system, which can be referred to as the Global Connectivity System, who need to be involved in shaping policies to

ensure that the system contributes to achieving sustainable development objectives.[8]
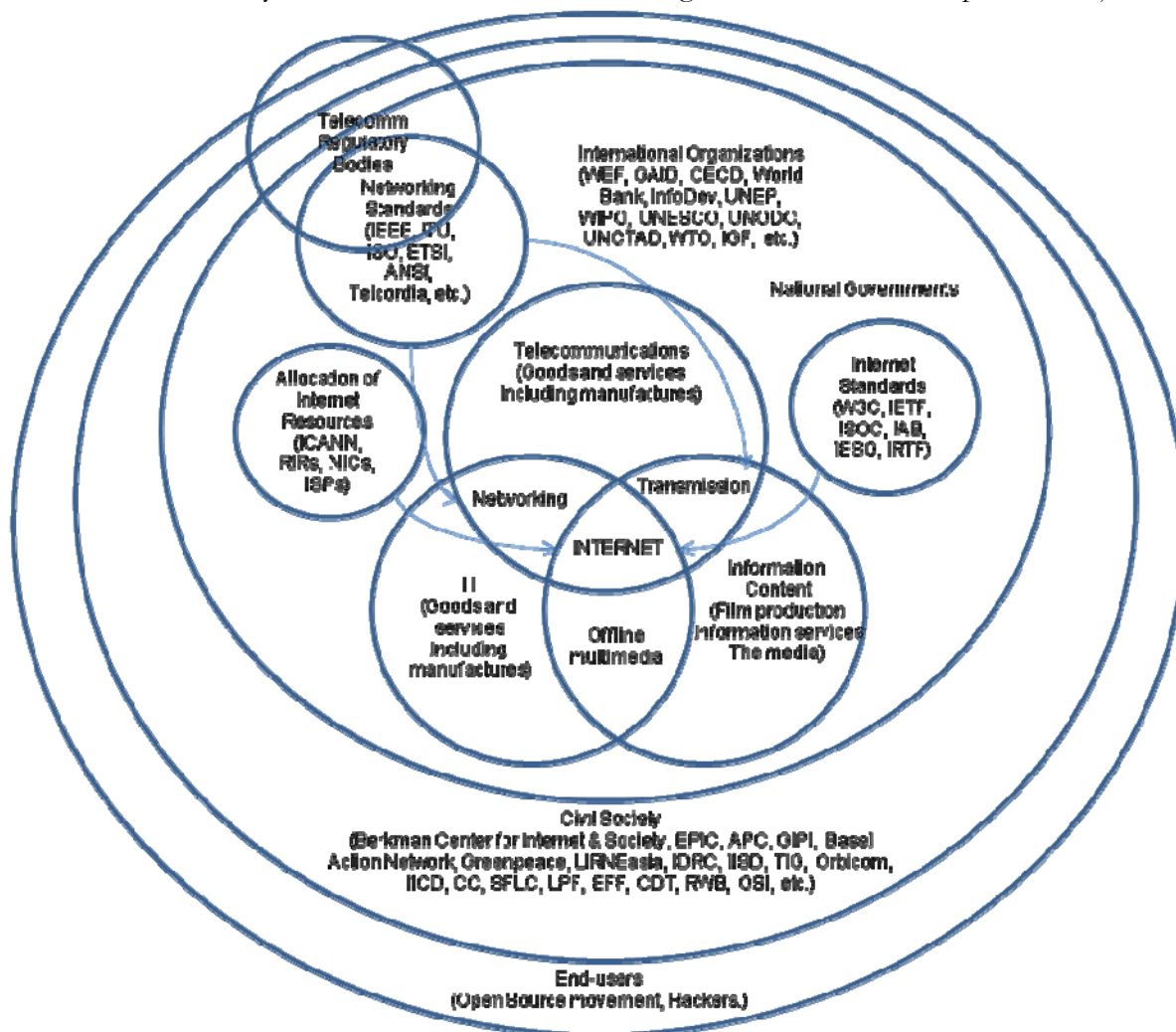
We grouped the main critical uncertainties across this system as follows:

- Content and services
- Infrastructure
- Decision-making processes
- Security
- Ecological Footprint

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[8] For a more detailed description of the Global Connectivity System, see Tony Vetter, *The ICT Sector and the Global Connectivity System: A sustainable development overview.* Winnipeg: IISD, 2008.

The *content and services* "layer" of the Internet is the one with which most users interact, most of the time. Recent debates related to this policy arena include those related to "network neutrality" (the principle that prevents any centralized body from "shaping" traffic and so deciding who gets what content, when they get it, or how they get it) and to the role of intellectual property rights in the digital environment. The question of the role of users as creators of content and services, and as active designers of their Internet devices (the "tethered" vs "untethered" debate) has recently gained some attention. A less publicized dilemma facing Internet policy-makers concerns choosing appropriate regulation philosophies from among those that governed previous mass and point-to-point communications technologies and services.

Uncertainties related to *Internet infrastructure* include those surrounding universal broadband service and major adjustments to the code, or logical, layer of the Internet: one such adjustment is the ongoing transition from one version of Internet Protocol (IPv4) to the next (IPv6). These infrastructure issues are of critical importance to the ability of remote regions and developing countries not only to get online, but to stay online in the future.

Questions surrounding Internet *governance processes* have focused on ICANN, the Internet Corporation for Assigned Names and Numbers. The description of the organization and its operations should be evaluated against the principle of multistakeholderism on which the future of effective Internet regulation relies. In addition to the work of ICANN, the role of users in Internet governance and the sustainability of volunteer efforts in the Internet Engineering Task Force must be considered.

Security is one of the most influential driving forces for the future of the Internet; indeed, with its transnational nature and unusual openness, the Internet can be seen as particularly risky to personal, economic and national security. Many subtopics fall under this broad heading, from creating user trust, to identifying and authenticating people and devices, to corporate or state-based firewalling, to the development national Internet security agendas. Recent trends toward cloud computing (where computational functions are delegated to remote servers on the "grid" and not to the local machine through which the user is accessing the network) make security concerns even more important.[9]

Decisions made about the Internet's future will inevitably have *environmental impacts*. As Tony Vetter notes, the good news about ICT-driven economic growth is that there is compelling evidence this growth is accompanied with reduced energy consumption per dollar of economic

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[9] Werner Vogels. *Expanding the Cloud: Microsoft Windows Server on Amazon EC2.* Retrieved September 30, 2008 from All Things Distributed blog entry: www.allthingsdistributed.com/2008/09/amazon_ec2_with_microsoft_wind.html

output through productivity gains and net gains in cost-effective energy savings.[10] Information carried over the Internet, however, is housed in data centres whose numbers are growing along with the network: according to market-research firm IDC, there were more than 7,000 data centres in the United States alone in mid-2008, and around 15 million servers. According to Bill St. Arnaud of CANARIE, the Internet is the fastest growing source of CO_2 in the atmosphere. St. Arnaud highlights that personal computers account for 50 per cent of the Internet's energy consumption, with server farms responsible for other half.

While the energy and emissions issues currently dominate discussions about the footprint of the Internet, less obvious, but of considerable concern are the issues around materials consumption in the production of equipment and the related implications of e-waste, including exposure to and disposal of the hazardous substances contained in electronic products.[11]

4.0 The Storylines

In this section we explore the "handshake" between the GSG scenarios developed to envisage a sustainable world, and the critical Internet uncertainties. Each of the four GSG scenarios is "enriched" with elements from each of the five critical Internet uncertainties, resulting in scenarios that contain more than the usual aspects of critical Internet futures. These storylines are a synthesis of the outputs of the three workshops.

4.1 Policy Reform (Regulated Market) Scenario[12]

The GSG Policy Reform scenario proposes that strong government policies be developed to harmonize economic growth with a broad set of social and environmental goals. This scenario is often considered to represent incremental (as opposed to transformational) change towards sustainability. Within this scenario, the Internet evolves as follows:

The Policy Reform world is characterized by a successful market-based model for the development and deployment of the Internet, accompanied by strong government policy. Innovation is high, although not maximized, since specific policy decisions restrict certain types of activity: security issues, including annoyances such as spam and malware are resolved through centralized solutions that force tradeoffs of freedoms to innovate at the network edge.

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[10] Vetter notes that one study has estimated that for every extra kilowatt-hour of electricity that has been used to power ICTs, the U.S. economy increased its overall energy savings by a factor of 10. See *The ICT Sector and the Global Connectivity System: A sustainable development overview.* IISD, 2008.

[11] For a more detailed description of the critical uncertainties, see Maja Andjelkovic, *Critical Internet Uncertainties: How will governance, evolution and growth of the Internet affect sustainable development?* Winnipeg: IISD, 2008.

[12] This scenario was addressed only by the Ottawa workshop and the first IGF workshop, not by the Diplo group.

Internet content is highly developed, and financing for Internet infrastructure is secure. There are innovative program funds focusing on ensuring universal access, allowing increased teleworking, reducing greenhouse gas emissions and facilitating international collaboration around issues related to global security, trade, the environment and others. The digital solidarity fund, an Internet tax on e-commerce of 1–2 per cent enjoys broad support, and generates income used to cross-subsidize access in places where it is not readily and easily available.

Most of the content is not proprietary and there are no concerns about the dominance of large firms or conglomerates online. Open source solutions are widely accepted as the norm. IPv6 has successfully replaced IPv4, after a smooth transition.

Basic universal access for all is achieved. It is maintained as a public good and pricing arrangements reflect this notion as their foundation. Policy supports business models that ensure investment in the network and on the perimeter, in a natural progression of the Internet from the1990s and early 2000s.

Regulation of a number of Internet activities has been brought into force as a result of a number of crises, including those related to climate, global finance and security. For instance, with GHG emissions caps and other incentives for reducing the human-made carbon footprint, server farms have become more efficient: instead of thousands of smaller farms, traffic relies on hundreds of bigger and better managed ones, strategically placed in geographic locations where their footprint is minimized. The cloud, which has led to a reduced need for computational power in consumer devices, has played a role in lowering the cost of providing universal access. Instead of PCs, home users rely on microprocessors in appliances (TVs, cell phones, etc.) for computing power. A reduction in the number of PCs would translate into environmental savings.

Although innovative policies promote the development of online public services, many aspects of daily life are highly dependent on the stability and security of the Internet, increasing systemic risk to the system as a whole. Significant investment into network and service redundancy is required to avoid the possibility of global crisis triggered by failures in the system. Investment in, and oversight of these safeguards necessitates some governmental involvement in international agreements around the governance of the Internet.

On balance, the model relies on government-business collaboration to ensure bottom-up development, economic, social and environmental sustainability and an enabling environment for private sector investment.

4.2   Unregulated Market Scenario

Powerful actors in the Unregulated Market Scenario advance economic growth through largely

unregulated markets that are also unfettered by environmental and social policy concerns. Governments are not necessarily weak; they have simply chosen a laissez-faire approach to most aspects of public policy. There is no consideration of equity for the poor and marginalized—those who are not in positions to help themselves.

In this scenario, the unregulated market goes through business cycles analogous to a sine wave. Internet issues play out in the following way:

With respect to the development and deployment of the Net, there are no intellectual property protections, no competition law and no business restrictions of any kind. Certain activities (for instance, reuse and modification of copyright protected material, music file sharing and collective knowledge production), previously considered to be violations of privacy, copyright and intellectual property rights (IPR) laws, as well as industrial espionage now flourish. Economic actors openly engage in cyber skirmishes and private information is traded as a commodity. As predicted by game theory, however, businesses eventually develop their own regulatory mechanisms to address some inefficiencies of market mechanisms. Over time, economies of scale allow the market to become dominated by a diminishing number of major players. In a natural progression, however, new technologies occasionally disrupt the established interests, returning the playing field to a multitude of smaller players, and restarting the cycle. Given the increasingly central role of the Internet in the global economy, employment flexibility—both on the part of employers and employees—is the norm, and traditional job security does not exist. With the IPR regimes gone, the open source community has the theoretical potential to thrive; however, encouraging new software development is difficult, since the cost of support is too great. Local and user-generated content flourish, although commercial benefit is difficult to realize in the points along the business cycle where few businesses dominate the market. Commercially viable enterprise is redefined and hinges on service delivery. Innovation follows the business cycle: it is very high when the business cycle is disrupted by new technologies, and stifled when major players eliminate their competition. Interoperability is difficult to achieve at the low points in the sine-wave cycle, i.e., where there are many market players. Since there is no competition law, individual companies are pushing for market share by developing those aspects of the Internet that can create high barriers of entry. Following a cyclical trend, this occasionally leads to a more fragmented Internet where the end-to-end connectivity principle is violated by technical incompatibility between networks and business disputes.

The growth in the number of Internet users slows down, since there is no business case to provide universal access. This leads to increasing marginalization of the extreme poor with the digital divide widening as businesses focus on serving wealthier customers. Pricing of access is determined through haggling, and depends largely on the negotiating capacity of parties involved.

Multilingualism thrives where there is a business case for it. Support of languages on the Internet is provided by online instantaneous translation for linguistic groups representing sufficient market opportunities. Those linguistic groups without access to the Internet simply do not find their languages supported online.

In the absence of government and the presence of a high degree of competition, there is no way to accumulate the wealth required to make investments in new, superior infrastructure, or to make major systemic changes.

Following full allocation of the IPv4 address space, IANA and the Regional Internet Registries are pressured by large business interests into agreeing to the creation of an IPv4 trading market. This initially retards the deployment of IPv6-compatible infrastructure as a market for IPv4 addresses is established. Early adopters of the Internet, predominately industrialized country organizations, hold the lion's share of tradable IPv4 addresses and the established Internet is increasingly controlled by powerful business interests. Countries that were not early adopters face having to pay very large sums of money for IPv4 addresses that others acquired at no cost. Emerging economies resort to deploying IPv6 compatible infrastructures; however, those controlling the established IPv4 Internet are not economically motivated to ensure interoperability. A parallel IPv6 Internet initially emerges and its users are overwhelmingly located in developing countries. However, growing commercial demand for IPv6 addresses driven by Internet of things applications for optimizing production and controlling consumer behaviour eventually turns the tide and the business case for managing the costs and complexity of IPv6 adoption dominates. Eventually, the tide of IPv6 adoption in industrialized countries overwhelms the IPv4 installed base and it is phased out.

4.3   VIPnet Scenario

In GSG's Fortress World scenario, powerful institutions protect the privileges of the rich and powerful elites by retreating in protective enclaves. Outside there is poverty and chaos. We have named the Internet variation on this scenario "VIPnet."

In the VIPnet world, only the elites have access to Internet technology. As a result, there are very few Internet users. At first, these elites are composed of individuals who have accumulated significant resource-based wealth; over time, however, those with technical knowledge overtake the central VIP roles. Volunteer Internet institutions such as the IETF disband and former members align themselves with power brokers, lending their skills and knowledge to the implementation of proprietary solutions to realize top-down control of their networks. Controllers of networks achieve a status equivalent to the kings and queens of old, exercising their wealth and power over their networks to protect their elite members from the masses.

Spam and the environmental footprint of the Internet are significantly reduced. There is also no need for a transition to IPv6. The Internet ceases to exist as a public network. Institutions that were dedicated to multistakeholder management of the Internet, such as ICANN, become irrelevant. Point-to-point communications from one elite member of society to another are more prevalent than community groups, although clusters of interconnected intranets, connected together with high levels of security, do exist. A central point of management does however exist, contributing to maintaining the global nature of the VIP networks by coordinating their interconnections. The high levels of security necessary to maintain status quo significantly limit the freedoms of privacy and expression over the networks for most users. Biometric and geo-location data are used to control users and prevent them from selling access to the VIP networks. There is little incentive to challenge the dominance of the English language in content and services. The networks cease to be mediums for the sharing of cultural and linguistic heritage. Instead, they serve to preserve and reinforce the dominance of the VIP culture online through control of content. Those not connected to the VIP networks are not subjected to this influence and are therefore able to maintain their own linguistic and culture identity offline.

The VIP scenario follows significant social conflict, environmental uncertainty and security concerns. The overarching principle guiding all activity is the maintenance of the highest levels of security. Following a large number of serious security breaches and cyber warfare skirmishes on the Internet, affecting essential infrastructure and services including power grids, air, space and sea navigation systems and water supplies, the open and free Internet of the 1990s and early 2000s has been all but eliminated. The notions of confidence, trust and convergence are no longer part of the vernacular, and average citizens can neither afford to connect, nor can they obtain security clearances necessary to access the Internet.

VIP status is extended only to the number of individuals necessary to make running a backbone viable. Whenever the cost of running the backbone drops, there is pressure to eliminate a portion of the existing elite and vice versa. Innovation is stifled by the static nature of the networks: the technology ceases to evolve.

The global economy is fragmented, a condition that resulted from a widening digital divide. E-commerce has adopted a brand new business model, eliminating the demand for domain names and therefore for ICANN. Trade and exchange are done privately, with no transparency.
Those without access increasingly live in a subsistence situation.

Outside of the VIP network, there are attempts by non-elites to recycle discarded devices and equipment (e.g., old cell phone towers) and create parallel networks. Although less capable than the VIP networks, the freedoms of the users of these lower end parallel networks are not restricted, not unlike freedoms enjoyed by users in the early days of the Internet. Sophisticated

technology repair capacity is beginning to emerge outside of the network, to take advantage of dumped technology. Occasionally, organized spectrum jamming efforts are staged in protest of the new VIPnet order, although these are easily thwarted by the elites. While there are competing tribes within the VIP world, they remain peaceful in an effort to preserve their collective VIP status.

4.4   Internet Commons Scenario

The GSG proposes a fourth scenario, the Great Transition to a New Sustainability Paradigm. This is based on the vision of globalization as an opportunity for forging new categories of consciousness, like global citizenship, sustainability, and the well-being of present and future generations. By taking a closer look at Internet issues, we have repositioned this as the Internet Commons Scenario.

The Internet of the 1990s and early 2000s has developed into a global Internet commons, through a smooth transition guided by enlightened policy choices. Process issues were fundamental for getting to this new paradigm: a full, multistakeholder Internet governance model has developed and stabilized. Inclusiveness of citizens in policy-making has created much greater civil unity and citizen-business alignment in some issues. There is recognition of universal human rights in the Internet context and a new alignment drives the world in realizing these rights in meaningful, practical ways. Infrastructure has been expanded significantly, due to joint pressure of citizen and business interests in having broader access that compliments the Freenomics model: a) business sees a need for much greater broadband to pursue new business models, and b) citizens and consumers demand easier communication. In response, government has invested in larger, more powerful, sustainable networks. Last mile access for the world's population has been achieved through planet-wide wireless coverage.

There is a flowering in content production because of new IPR regimes, similar to the creative commons scheme. Open software platforms become intelligent, able to fix and repair themselves automatically. The security front is redefined, with the notion of privacy having seen a marked generational change in 2050: individuals have much more control over their own identity, thanks to the creation of technology tools to ensure trust and reduce the need for any kind of central control. On the footprint side, the accelerating environmental crisis, with a tipping point in 2018, led to the development of technology that resulted in a zero footprint. The Internet Commons Scenario places the global community in repair mode, strengthened by a communal understanding that maintaining environmental sustainability is essential for survival.

There is a great respect for nature, reflected in a positive change in lifestyle through reduced consumption. Digital natives have led the effort to reduce demand for physical objects. Remaining demand is met without harm to environment.

Energy consumption is down, with efficiency increased. More and more people come to see the distinction between development and economic growth. Attention turns to qualitative aspects of the good life, including shorter work weeks, community involvement, relationships, etc. Exclusive vehicles for delivery of content (e.g., DVDs) have been eliminated through new technology. A free and open, inclusive Internet results in better education and increased global citizen movement. While GDP goes down, the Gross Happiness Index increases.

The business model combines free and paid content, along with advertising, building on the model pioneered by Google. The shift occurred largely through a generational change, with society realizing that money can be made not only by tightening and controlling access but also by opening access and giving things away. As a result, the model is dependent on universal access: it flourishes as long as there are people on the network. Global development has brought in developing countries to take part in this Commons.

5.0 Observations and Next Steps

The objective of this initiative was to use the GSG scenarios as a frame within

One of the groups extended their thinking on the possible future of the Internet in this Internet Commons Scenario to beyond 2050. Their variation is included here as an adjunct to the above view. Eventually, the imbedding of low cost human-machine wireless interfaces becomes the norm allowing individuals to access the Internet by thought alone, thus realizing the goal of universal access to knowledge for all. Instant translation services augmented by thought-based feedback mechanisms ensure full and instant comprehension of all languages, allowing for complete multilingualism on the Internet. Vulnerabilities to health effects resulting from increased exposure to wireless signals are eliminated through genetic engineering. Messaging becomes thought initiated. Telepathic communications with close friends and family members is possible. Control of this interface remains with the (human) end-user.

To solve problems of hacking, theft of information, invasion of privacy and even mind control, security tools based on DNA sequence identification guarantee personal online protection and privacy. Each human-machine interface is activated only by an individual's unique DNA, making identity theft impossible.

As thought-based access is universally adopted, a paperless society is finally realized. With instant communications, business meetings and trips also become unnecessary, so people travel only for leisure and pleasure. The proliferation of wireless last mile access and human-machine interfaces is also driven by the desire to reduce material consumption through the dramatic reduction in use of wires and computer terminals.

which to consider the future evolution of the Internet. Global scenarios serve as narratives of our progress towards, or away from, a sustainable future. To date global scenarios have not included many specifics regarding the evolution of the Internet. This initiative sought to consider how the Internet might evolve differently in each scenario and how major global trends and possibilities might impact the Internet we know now. At the same time, given the increasingly critical role the Internet is playing in economic growth and issues of social cohesion, this initiative also prompted thinking about how the handling of these critical uncertainties about the Internet today might reinforce one trend or another. It is hoped that deepening consideration of this bidirectional influence will enhance and refine the logic of the global scenario storylines to include proper consideration of the role of the Internet in our sustainable future.

The three workshops mobilized the knowledge and the creativity of over 85 Internet policy, sustainable development and scenarios experts to consider critical Internet uncertainties in the context of global scenarios. The outcome was the four storylines of the future of the Internet described earlier, each reflecting one of the GSG scenarios, but enriched with certain outcomes of the critical Internet uncertainties that matched the essence of each of the scenarios.

Of course numerous other outcomes may have been possible and feasible which were not explored through these initial attempts. One should keep in mind that scenarios are stories about the possible futures and how to get there, and do not reflect the probability of any future at all. Rather, scenarios are meant to provoke thinking not only about the future but especially about necessary and possible decisions in the present to advance the most desired scenario.

Global sustainability is reached in a certain way in each of the four scenarios. GSG suggests that their Great Transitions Scenario shows the most promise along all dimensions of sustainability. With greater attention to Internet issues, the importance of multistakeholder roles and responsibilities in securing a global commons is reinforced. What is particularly intriguing is the level of attention given to a real change in economic models that comes about through the advancement of the Internet. What is also interesting is that while both the Policy Reform Scenario and the Internet Commons Scenario propose real gains on the environmental front, only the Internet Commons Scenario suggests that current damage can be repaired.

GSG's Policy Reform Scenario is sustainable along the lines of the report of the Brundtland Commission on Environment and Development, which gives priority to government policy-led societal transformations. In adding the Internet lens to this scenario, we saw that, as with the Internet Commons Scenario, the role of business remains central to the sustainability equation; however, government regulation on issues of rights, privacies and security have led to a reduction in innovation. And, for some reason, the security of the whole communications system is vulnerable in a way that did not emerge in the Internet Commons Scenario.

GSG suggests that sustainability is less likely to be reached in "Fortress World," and the VIPnet scenario is consistent with this finding, because of the lack of social sustainability. VIPnet goes so far as to suggest that lack of attention to the digital divide is a contributing factor to the fragmentation of the economy that is a distinctive feature of Fortress World.

The Unregulated Markets Scenario, with its problems with both environmental sustainability and equity, is also less likely to lead to global sustainability. It is interesting to note that the Shell Global Scenarios 2025 suggest that adverse reactions to the disappearance of borders through the growth of the Internet may lead to profound "bilateralization" and protectionism. We think in this scenario that rampant unregulated globalization of the marketplace may lead to profound "bilateralization" of the Internet—and that it is the bilateralization of the Net, not its growth, that will reinforce global bilateralization and protectionism.

The causality of interactions between the critical Internet uncertainties and the GSG scenarios was unsolved in this first attempt. In most cases it is plausible that there will be co-evolution between the outcome of critical Internet uncertainties and the resolution of other global challenges. However these integrated scenarios did provide fresh perspectives and insight on Internet futures. One of the most significant outcomes of the Hyderabad workshops was the recognition of the importance of addressing a range of Internet issues together rather than focusing on single challenges in isolation (IPv4/IPv6; net neutrality; security; and so forth). Further, the emergence of a strong global multistakeholder governance process endorsed by a global citizens' movement may greatly help to resolve the "process" aspects of Internet governance in a favourable way as described in the Internet Commons Scenario storyline. As well, one could see potential for the emergence of a policy handshake: actions in the realm of advancing sustainable development have important implications for the Internet and decisions within the world of the Internet influence the prospects for sustainable development ("if you care about sustainable development, you should care about the future of the Internet, and vice versa").

This is a first attempt at making these linkages. It is hoped that the four storylines of the future of the Internet and sustainability will provoke further thinking on necessary and possible decisions about critical Internet uncertainties that will advance the most desired global scenario.

We have established a Web site at groups.iisd.org/internetscenarios/ to continue discussion of this work. We look forward to your comments.

6.0   Appendix: Participants List

6.1   Ottawa Workshop, October 23–24, 2008

Ben Akoh, ICT/Media Program Officer, Open Society Initiative for West Africa; Dakar
Maja Andjelkovic, IISD Advisor
Josie Brocca, Industry Canada
Heather Creech, Director, Knowledge Communications, IISD
Willie Currie, Policy Advisor, Association for Progressive Communications
Heather Dryden, Policy Advisor, International Telecommunications Policy and Coordination, Industry Canada
Bill Graham, Strategic Global Engagement, Internet Society
Byron Holland, President, Canadian Internet Registration Authority (CIRA)
Don MacLean, IISD Associate
Bill Munson, Vice President, Industry Technology Association of Canada (ITAC)
Paul Raskin, President, Tellus Institute
Dale Rothman, IISD Associate
Isabelle Roy, Team Leader, Science and Technology Group, CIDA
Richard Simpson, Director General, E-Commerce Branch, Industry Canada
Philip Vergragt, Professor Emeritus of Technology Assessment and Senior Associate, Tellus Institute
Tony Vetter, Project Officer, Knowledge Communications, IISD

6.2   IGF Workshop, December 3, 2008, Expert commentators

Willie Currie, Policy Advisor, Association for Progressive Communications
Liesyl Franz VP, Info. Sec. Programs & Policy, Commercial Sector, Information Technology Association of America
Shalini Kala, ENRAP Program Coordinator, International Development Research Centre, New Delhi
Jyrki Kasvi, Vice Chair of the Committee for the Future of the Finnish Parliament

6.3   Diplo Workshop, December 5, 2008, Co-organizers

Vladimir Radunovic, Diplo coordinator of the Internet Governance Capacity Building Programme
Ginger Paque, Diplo Internet Governance Capacity Building Programme