

Internet Futures Scenarios

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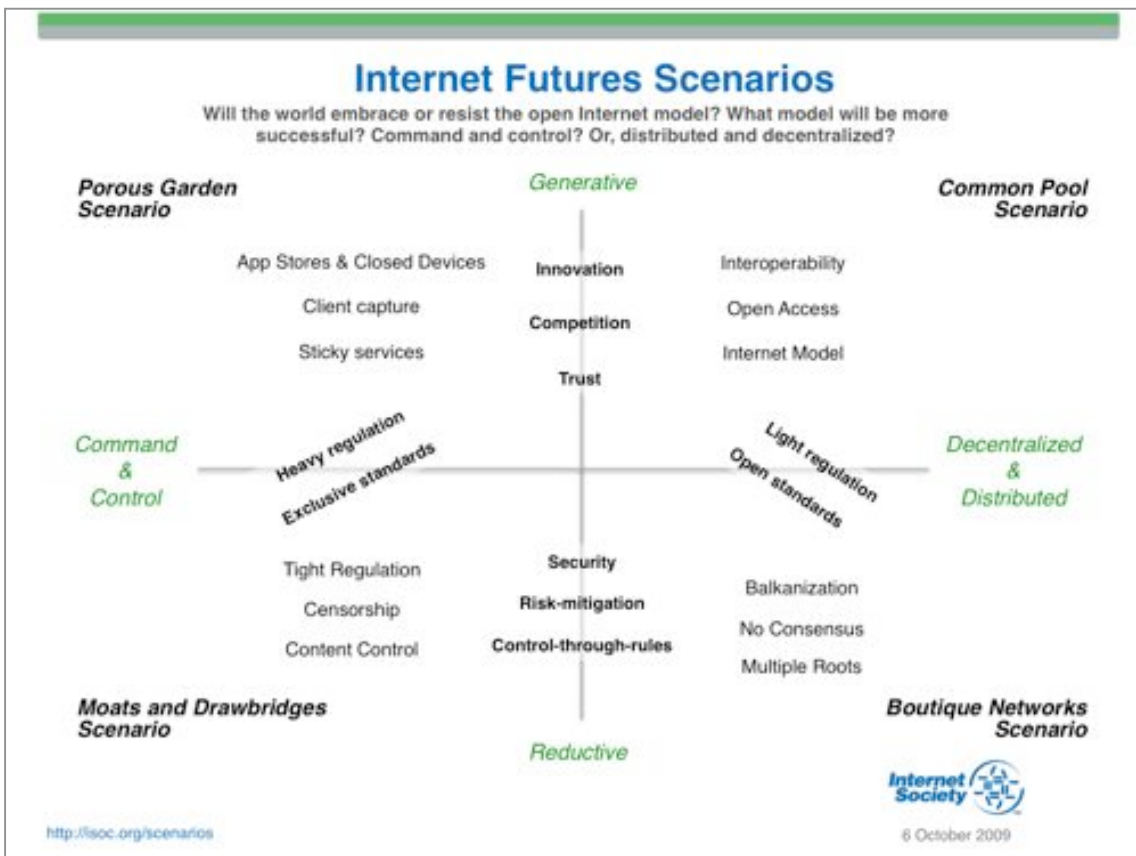
Introduction

Recently, senior staff at the Internet Society engaged in a scenario planning exercise to reveal *plausible* courses of events that could impact the health of the Internet in the future. The results of the exercise were subsequently reviewed with the Internet Society Board of Trustees. While obviously not intended to be a definitive overview of the landscape or all potential issues, we believe the results are interesting and, we hope, thought-provoking.

We are sharing them in the hope that they will inspire thought about possibilities for the future development of the Internet, and involvement in helping to make that happen in the best possible way.

Scenario planning is a methodology used widely in business and increasingly in other sectors to allow organizations to anticipate how the future could turn out. It is particularly useful in an environment of great uncertainty. Scenario planning is neither guesswork nor statistical analysis. It is a structured process to help organizations break free from ties to "the official future" to consider other possibilities that they may confront. The stories that result from this process are intended to reveal plausible courses of events, not probable ones. While they are imaginative, they are intended to make the organization aware of possibilities that could have an impact. The organization then uses the stories as a springboard to help identify robust courses of action that will position it well for any of the possible futures.

Scenarios always start from a question about the future. In this case, the focal question for the exercise was: "Will the world embrace or resist the open Internet model?" with a second-level question to narrow the field: "What model will be more successful? Command and control? Or, distributed and decentralized?"



These two questions defined four quadrants, which led to four very different stories about how the world might develop over the next eight to ten years. Each of the stories are below, along with factors that could drive towards these scenarios being realized, and factors that could work against the Internet from moving in that direction.¹

All of these stories contain some element of the Internet that exists today, as you would expect. And the Internet of tomorrow will almost certainly not look exactly like any of the stories. But you will see that each of the four scenario stories presents a different and plausible direction that the Internet might evolve towards. We believe that the Internet of 2015 will contain some of the characteristics of all four stories.

We Need You to Participate

The challenge for the Internet Society, and for everyone who cares about the Internet, is to think about the possibilities and tendencies they prefer or want to avoid, and what they can do in their circumstances to help the Internet to evolve in a positive direction. The Internet Society community actively works to try to ensure that the Internet of the future will look most like the story called “The Common Pool”. We hope you will join us in our efforts.

The Internet Society hopes that you find this material helpful, and we look forward to engaging with you in a wide discussion of how we can ensure that the Internet of the future truly is for everyone.

¹ Also online at: <http://www.isoc.org/scenarios>

Common Pool Scenario

"There is nothing new to be discovered in physics now. All that remains is more and more precise measurement."

Lord William Kelvin, 1900

Quadrant

The Common Pool quadrant is about positive “generative” and “distributed & decentralized” properties. Opportunity and growth abound (generative) and there are no insurmountable barriers to entry for those wishing to take part (decentralized and distributed). Disputes and challenges are resolved through competition, as opposed to negotiation or inherited rights. This quadrant is about constant evolution, and it features a healthy ecosystem. That ecosystem – the interlinked network operators, developers, infrastructure providers, resource management organizations, etc. – is the key to the generative nature of this quadrant. Organization and operation tends to be “horizontal”, not “vertical”, so that the underlying building blocks (technologies, networks, etc.) are available to all to build upon. The “win” for the Internet is that it retains the ability to react and respond to new requirements.

Factors driving towards this scenario

Driving forces that lead the Internet into this quadrant are competition and desire to leverage the benefits of economies of scale (in open development and interoperable systems). Players feel in control of their own destiny because they have the ability to rebuild their future if need be (evolve, innovate).

Factors attracting away from this scenario

Forces that pull the future of the Internet away from this quadrant include concerns about loss of control of one’s destiny (national, commercial, personal) and attempts to preserve individuals (rather than the population).

Narrative

In the beginning there were many networks, and they worked to hook up together so that diverse endpoints could connect, pass traffic, coordinate, share data. The network was more than the sum of its parts - it included the results of efforts by the operators who thought making connections (physical, software, or communication) in the middle of the night was fun in its own right. It's not that they were altruistic, so much as they were playing, and the opportunity for New and Exciting abounded. Management could go ahead and make whatever decisions they wanted, but Root ruled the roost. When one operator got lazy and wrote a script to search anonymous FTP archives for files of interest, others caught wind of it and asked for the data, and scripts—the Internet's first search engine, and one of its first commercial activities, was born. When another technical person, across the ocean, needed to find a way to allow researchers to publish and share research activities, a method of linking remote files was created—the result was a pragmatic solution to a common problem. All of these people found common cause in the Internet Engineering Task Force (IETF) — a rough and ready group of engineers tinkering with the running code of the Internet.

By 2009, the proportion of technical people "playing" with the Internet was dwarfed by people building networks for Serious Business. "Where," they asked, "is The Plan?"

Perceiving none, by 2012 they brushed aside these amateur efforts, claiming Methodology was more important. They flocked to more conventional business meetings, and built roadmaps and technologies by pushing blocks and lines around PowerPoint diagrams. "Network architecture can be expressed in bubble diagrams!" they cried, "so if we edit the bubbles, we're adjusting network architecture," they concluded. They lobbied governments, near and far - "it's in the best interests of your citizens; we'll organize it all."

When concerns were raised about the possibility of locking out new entrants and opportunities for innovation, they were brushed off by Industry Experts, "There is nothing new to be developed in the Internet now. All that remains is more and more precise service implementation."

Over the course of the next three years, all eyes were focused on the major incumbents, who were demonstrating their prowess by developing multi-tiered deployment plans for the Future Network, resolving known issues through hard-fought negotiations between powerful industry players.

And: nothing happened.

Incumbents deployed the bubble-diagrammed technologies to great fanfare and little effect. Notably, each network's implementation varied just-ever-so-slightly from their competitors', so interoperability failed at all but the most basic (existing) levels.

In the meantime, the plain folks, who'd been too busy working out the algebras of trust transitivity and the core scaling issues of existing network technologies to attend these multi-week suit-sessions, had scaled new heights of finessing technology and developed ugly-but-functional approaches to critical problems with the Internet. Created by open, collaborative process, and published in freely-accessible documents, new entrants to the Internet (networking and applications/services) seized these tools to build the Next Big Thing. It wasn't pretty; it didn't flash; it wasn't intellectually or aesthetically impressive. It just worked. And solved an existing problem. So the new entrants handed the incumbents their lunch (again). Cognoscenti hid out in their basements, firing up creaky VHS players to listen to David Lynch's sage giant from "Twin Peaks" - "It is happening... again."

There was much upheaval, wailing and gnashing of teeth, appeal to governments for redress (or at least a bailout), some failed, some adjusted, and many applied the newest economic fad, acquiring the customers and assets of the new entrants through corporate "leveraged lease-to-buy" options.

Meanwhile, as the network and service operators thrashed each other in pursuit of larger market share, network users reveled in the new opportunities afforded them by innovations from all corners of the globe. Retirees took language courses by video connection with independent teachers in other parts of the globe. The established music industry was left in the dust as independent artists networked to promote their collective music activities.

There still was no master plan and were no guarantees. In the end, the power of global evolution, favouring the success of the population over the preservation of the individual, prevailed. Constant innovation is here to stay. Trying to fix things in place is like trying to fix a peg in an ice dam: it might appear to be fixed, but constant incremental shifts are always driving (powerfully) in a new direction. Ride that wave, or be left out in the cold.

Boutique Networks Scenario

""In the strictest sense of the word, boutiques would be one-of-a-kind but more generally speaking, some chains can be referred to as boutiques if they specialize in particularly stylish offerings...

...Although some boutiques specialize in hand-made items and other truly one-of-a-kind items, others simply produce t-shirts, stickers, and other fashion accessories in artificially small runs and sell them at unusually high prices.”

Source: <http://en.wikipedia.org/wiki/Boutiques>

Quadrant

Based on a reductive but de-centralized model, the Boutique Networks scenario envisions a future in which political, regional, and large enterprise interests fail to optimize on the social and economic potential of a shared, global set of richly connected networks (the Internet). It carries the weight of self-interest brought by factions seeking to optimize control in small sectors (political and otherwise). It also posits that these fractionalized networks will continue to leverage the benefits of existing Internet standards and technology. This is in some ways the classic “tragedy of the commons”. Each of the proprietary providers extracts as much as possible from the common pool while giving little back.

Factors driving towards this scenario

Major drivers may include politics, special interests or requirements, and risk mitigation (local determination vs. fate sharing). In some cases these networks may be developmental/experimental in nature and will naturally drift back towards interconnection, but in some cases—particularly when regional politics are involved—the networks may harden into more classically balkanized forms.

Factors attracting away from this scenario

How can we encourage re-connections among the boutique networks and the Internet? Although this scenario explores the drivers that would cause networks to begin to separate themselves into smaller stand-alone segments, it also assumes that those networks will be based on existing standards and hardware. As the individual networks continue to advance, they can be encouraged to return to the broader Internet in order to widen their development options and to achieve the economies of scale offered by commodity hardware and open standards. Stand-alone networks may also find value in interconnection in order to access additional content, reach new audiences, and operate services (such as global emergency services) that require global co-operation.

Narrative

By the end of 2009 it becomes clear to most Internet technology insiders that global deployment of IPv6 is a failure. The individual Regional Internet Registries

(RIRs) have become caught up in regional concerns about how to manage the run out of IPv4 addresses. While each has a set of well thought out policies concerning IPv4 depletion and IPv6 deployment, the lack of global coordination has lead to increased fractionalization. The so-called tier-one Internet Service Providers begin to micro-manage their existing IPv4 allocations in order to conserve resources and maintain control of their downstream customers. Service provisioning becomes more and more about connecting nested NAT deployments through small, static IPv4 "gateway" assignments. This creates increasingly insular regional and enterprise "intranets" with limited options for global transit. For many users this is a sub-optimal experience.

Businesses find that they must establish their own network nodes and agreed upon connections to get business done. Enterprises that must inter-operate via gateways begin to deploy middleware solutions (identity management, authorizations, proofing, transaction accounting, etc.) to track and manage access to and among their intranets. This breaks end-to-end and large sections of network content become guarded/controlled. In 2012 major search engines begin to refocus their businesses as less and less interesting material is available to probe and index. Search becomes localized and content providers work to establish "prepaid" micro-payment systems for both specialized search services and content display.

End user experience varies greatly and most "services" come at a cost. Users may pay multiple charges for "advanced services" packages. Users in some countries only see what government wants them to see. Services can be tailored with limited reachability and clear traceability to "owner accounts" which can be held accountable for access and incremental payment schemes based on usage are common. There are also limited markets for some content due to division of interest and service. Content provision often falls to the cable model (multiple packages, specialized channels, "child safe" service offerings, for pay content, higher charges for specialized topics, etc.).

Some countries move aggressively in creating their internal IPv6 only networks and in 2011 several opt out of the ICANN blessed DNS root infrastructure altogether and set up their own local roots for their IPv6 networks. New vendors now shop their own cheap networking equipment in emerging markets and configure and market based on regional requirements. Equipment, documentation, and training all come pre-provisioned with alt.root examples, as needed.

Other governments follow the IPv6 early adopters' example and effectively take their countries "off net". Some pursue their own schemes for addressing. These networks overlap existing address allocations in the "old" Internet and cause major problems when they occasionally leak to the remains of the global Internet.

The institutions that govern unique addresses are unable to counteract all of these challenges. By 2012 there is no single bottom up policy environment for governments to interact with enterprise. The ITU steps forward with their next generation model which includes a vision of multiple internets: things, services, etc. and step into leadership as the standard for interoperability among the multiple types of "internets". They offer to manage different roots for digital Identity, RFID, etc. and offer guidance to governments in setting up and running their own roots.

The "old Internet" continues to exist, but by 2015 the existing IP standards are no longer being actively developed and are not working well with the new environments. The problems caused by spill over from poorly managed boutique networks also undermine the value of global interconnection. IP is now a utility. The funding model no longer supports innovation and major investment comes from governments looking to coordinate cross-border emergency services (the internet of things). This brings heavy regulation and classic treaty like agreements. Governments assert ownership of "critical resources" within their own borders and regulate peering agreements.

In 2017 the Internet Engineering Task Force (IETF) disbands and the IETF Trust assets are signed over to a hobbyist organization originally founded by HAM radio users. Users who remember the old days start to trade classic software and run their own FIDO net nodes...

Moats and Drawbridges Scenario

Quadrant

This quadrant is in the space characterized by command-and-control and reductive² orientations. In this quadrant, the world of the Internet would be heavily centralized, dominated by a small number of big players who create their own rules in a few "big-boys' clubs." Conflicts are resolved through negotiation, not through competition. Connections between networks would be the result of extensive negotiation and deal making as well. There would likely be strong regulation as governments seek to impose some public interest obligations on the industry. There might even be controls on what equipment users can connect to the network. A great deal of content would be proprietary and protected by strong intellectual property rights. Governments would be able to control the behaviour of networks and network users through legal mechanisms and sanctions. There would be high barriers to entry. There would not be much incentive to expand the reach of networks beyond the largest and most wealthy customers or regions. Innovation would be slow and only happen when it would benefit the network owners. There could be close political links among all players to their mutual benefit.

Factors driving towards this scenario

The chief driver in this quadrant is the big players' and governments' desire to maintain control of their own destiny and their national interests in a threatening world. In the economic realm, the big firms' actions are self-interested and predicated on the idea that there are limited benefits to be shared. Business models are based on maximizing current benefits. In the political realm, too, the status quo is preferred over change. Power is maintained by supporting the big business players, building alliances with organized labour in the political realm, and using legislative and regulatory instruments to impede change. An element of fear is also a driver – a fear that if the Internet is not tightly controlled, Bad Things will happen; for example, in the realm of cybersecurity, child protection, political agitation, etc.

² characterized by or causing diminution or curtailment

Factors attracting away from this scenario

What forces would work to keep the Internet from being sucked into this quadrant, where communications networks have been before, or to entice developments in a direction we'd like better? A market-friendly regulatory environment would make it hard to consolidate into huge corporations capable of exerting control. Stressing the dangers of large centralist solutions to problems (security, child protection) and favouring the thoughtful use of targeted instruments where necessary. Continually reinforcing the role of the open model in promoting innovation, development, and reach of networks. Promoting the Internet model of open networks. Encouraging development of new mechanisms that will reward creators and holders of intellectual property without imposing regulatory restrictions on distribution.

Narrative

In 2009, the new Obama administration took power in Washington. Despite predictions that it would be Internet-aware, and support open development models, by the end of its first year it was obvious that the new appointees were not going to advance Internet-related policies founded on the principles of nondiscrimination and transparency. This gave rise to a series of reversals for network neutrality advocates. The resulting FCC regulatory framework allowed network operators to implement traffic shaping. The third new economic stimulus package introduced late in the year created incentives for existing network operators to rapidly expand broadband access to every home by allowing new pricing models for Internet services and content, which brought to an end the "all you can eat" model, and then resulted in a series of alliances and major takeovers of content providers. Giggle-i-Zon and MyPipe; Yipee! grew rapidly, but the Tinysoft-Bcast-TimeNDate alliance quickly moved into the lead position based on its unbreakable grasp on users' eyeballs in the United States. Fear-mongering by an already defensive media alliance during the administration's contentious but ultimately successful attempt to pass an omnibus cybersecurity, anti-spam, privacy, electronic decency and national identity card bill caused the expanding new generation of Internet users to rush into the new walled-garden environment where there may not be much to eat, but consumers would know it was clean.

The European Union feared that the new American megacorporations would flood their cultural market place with American junk content, and took steps to empower their incumbent network operators' acquisition of European content providers. The intellectual property rights (IPR) lobby rejoiced when the European Court of Justice over-ruled the ability of the Constitutional Council of France to reject the draconian HADOPI.v3 law. By 2012, Europe had its own convergence champion, as all the major networks and content providers united under the banner of Allo!EU!, a huge e-shopping mall protected by a high fence of filtering technologies that eliminated access to all non-European content and anything not previously approved by the Union of National Academies of Good Intentions. Australia had taken an early lead in filtering technology, and the national broadband initiative made it easy for the new monopoly to impose an ever-widening ring of controls on Internet users. As the megacorporations expanded their control over all global networks, they naturally imposed their closed access models. Soon the global Internet was reduced to a set of feuding private conglomerates of convergence.

These rapid developments effectively ended long-standing disputes between western countries and the traditionally more-controlling and repressive states. The long-standing Internet governance debates finally drew to a conclusion in 2014, once it became feasible to control all conditions of access at the national level. The United Nations abandoned its goal of creating an Internet treaty as member states found other means of controlling the network and their citizens.

As significant was the emergence of multiple proprietary standards, each imposed by the megacorps on their fiefdoms. The traditional Internet organizations fought to remain viable, but their inability to require conformity with the standards developed by the IETF, W3C and other bodies dedicated to connecting users rather than entangling them collapsed when their one-time supporters joined or were gobbled up by the megacorps. The “Internet” devolved into a small specialized artifact, used only by academics, researchers, and the military who were relieved to have been unburdened from the weight of non-expert commercial users, and the bands of thieves and con-artists attracted by them.

But by 2015, the megacorps recognized that newly developed real-time translation capabilities opened the possibility of cutting content production costs as material produced for one market could easily be marketed in another. Global alliances began to form, creating a need for interconnection standards. The ITU leapt at the chance to fill the need for a new global standards body, based on its long-standing assertion that it was the place where people talk about cybersecurity. Governments and their national megacorps were quick to agree. The Next Generation Network was finally realized, giving new meaning to the phrase “network of networks” in the post-convergence mega universe.

Porous Garden Scenario

Quadrant

This quadrant is characterised by command-and-control and generative³ orientations. In this quadrant, networks would remain global but access to content and services would be tied to the use of specific networks and associated information appliances. Individual (business) viability would triumph over the economic potential of the common pool of the Internet. Financial incentives for content producers and software developers would result in continued innovation *within* the appliance-based model. Control over suitability of content, pricing, licensing and other concerns would be firmly in the hands of relatively few large commercial organisations. Proprietary, closed technologies would abound and exclusive deals with content producers and physical communications networks would result in consumers having to purchase multiple appliances and associated subscriptions to avail themselves of the full range of innovation on the network.

Factors driving towards this scenario

The overriding driver in this quadrant is the desire of both large commercial organisations and niche content providers to increase their margins and the profitability of their businesses. These organisations desire greater control over

³ Having the power of generating, propagating, originating, or producing.

their commercial destiny. This applies to producers of both hardware and software products and to network operators. Other drivers include the desire to control access to content either to increase its value or to ensure the maintenance of centrally imposed standards. These standards may be intended to provide a more guaranteed user experience, to produce more reliable products, and to prevent the use of appliances for running applications or accessing content deemed undesirable by the manufacturer. Fear is a driver here too—fear of lack of profitability leading to business failure, and fear of the consequences (for brand, reliability, profits, control) of exposing platforms to the open Internet.

Factors attracting away from this scenario

What forces would prevent this quadrant from coming to dominate the reality of the Internet? The desire of consumers not to be controlled or artificially restricted in their ability to use devices that they have purchased outright is a very strong force. Open alternatives to closed information appliance platforms also provide a check on the extent to which appliance vendors can exert and extend their control.

Narrative

In mid-2009 over 3000 applications were downloaded from the Acme Application Store every minute. The release of the Acme's updated smartphone in 2010 so increased their share of the Internet-enabled mobile device market that all other handset manufacturers raced to adopt their business practices. The mobile operators successfully transitioned their business models to replace voice and call termination revenues (regulated down to a minimum) with a combination of data tariffs and app-store payments garnered from subscribers eager to own the latest in a long line of shiny networked toys. Mobile operators that failed to secure exclusive partnerships with the most popular platforms withered.

The development community was quick to take notice as more and more individual developers or small teams became hugely wealthy as their \$2 apps were downloaded by millions. Open source solutions increasingly lagged behind the features and functionality of the closed, yet (almost) freely available alternatives. Protocol development became the preserve of closed clubs of partisan developers only interested in better enabling their chosen platform to rise above the competition and thereby net their apps more download revenues.

The global and unprecedented havoc wrought by the Netficker.OMG virus in 2011 nicely complemented the already well established lobbying and publicity efforts of Nemesis Research and others which consistently portrayed the open Internet and open technology base that supported it as a threat to the stability and security of developed economies throughout the world. The backlash resulted in a huge increase in sales for the newly released Acme and Beta netpods—networked information appliances that were the first such platforms that came with guarantees of software quality and assumed liability for any personal damages arising from use of the appliance.

By 2015 choosing a platform for Internet access was almost as important as choosing a life partner. Subscribers quickly found that they had invested so much in third-party services and applications that changing to an alternative provider was unthinkable. Consumers were persuaded to trade almost all personal privacy

for applications and services that offered unprecedented functionality and ease-of-use, and personal identity became embedded within their chosen appliance. Teenagers rebelled against their parents by switching information appliance platforms and adopting whatever was most different to the platform their parents had brought them up on.

As software development of third-party applications for information appliances became increasingly lucrative for developers and increasingly risky for vendors and operators as the scope of their liabilities widened, software development became highly regulated. Developers became licensed professionals, provided with the tools they needed by the information appliance vendors and offered free connectivity by the operators in return for maintaining a veil of secrecy over the inner-workings of the platform they were developing for.

The largest ‘tribes’ of information appliance users and developers—the Betabots and the Acmecores—regularly engaged in baiting each other with the perceived supremacy of their respective platforms. This simmering animosity peaked after a scheduling snafu resulted in both Beta and Acme’s main developer conferences being scheduled simultaneously in San Francisco. The streets ran with the caffeine-rich blood of coders bludgeoned to death with shiny, multi-function communication devices.

Ultimately the number of major networks dwindled to the point that any effort to optimise across anything broader than the subscriber base of a single network was abandoned. At that point the networks were floating in space, unconnected and unable to agree on ways to share access to each other’s revenue streams. The business model remained highly profitable for platform vendors, operators and developers, although the inefficiencies of developing applications separately for each platform went un-costed. The true potential of an open innovation platform was never realised and individual freedom and the greater good of society was sacrificed in the face of irrepressible market greed and a fear of the alternatives.

About the Internet Society

The Internet Society is a non-profit organization founded in 1992 to provide leadership in Internet related standards, education, and policy. With offices in Washington, D.C., and Geneva, Switzerland, it is dedicated to ensuring the open development, evolution, and use of the Internet for the benefit of people throughout the world. More information is available at: <http://InternetSociety.org>