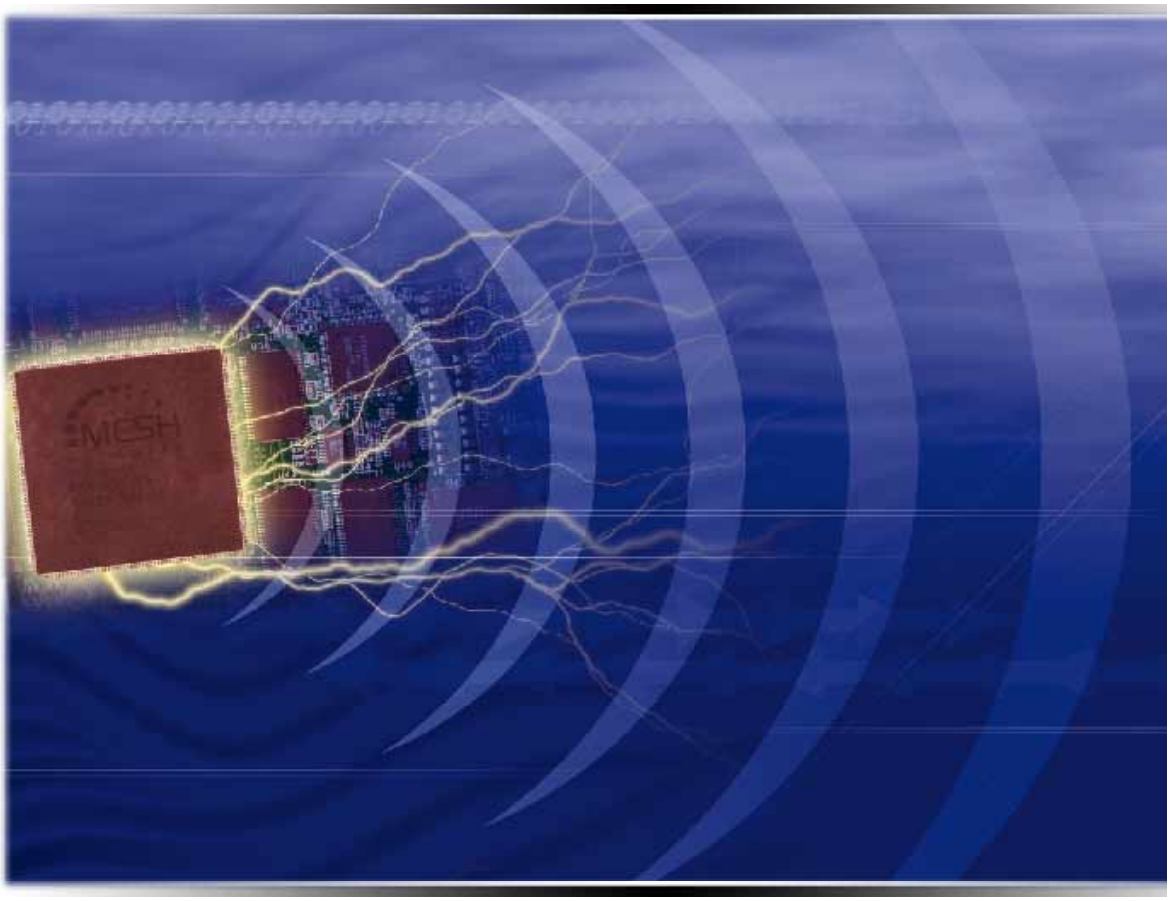
FOSTERING DISRUPTIVE TECHNOLOGIES



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Fostering Disruptive Technologies

Every few years a rare breakthrough occurs. A new technology appears that is not just an incremental upgrade, but has the potential to become truly revolutionary. The telegraph. The railroad. The radio. The telephone. The transistor. The PC. Such a technology "disrupts" the existing marketplace -- and creates a new opportunity for improvements and benefits in our global society. Two key characteristics of such disruptive technologies are that they disrupt the pace of the evolutionary cycle within an industry and they permeate the industry and well beyond, enabling new industries – and new "killer" applications.

Today, we are enjoying the results of two recent disruptive technologies and their revolutionary changes: wireless communications and the Internet. These technologies have provided totally new opportunities that have contributed to convenience, safety, productivity, and creativity of people throughout the world.

The visionaries who believed in these technologies and worked to bring them to fruition had to contend with the inherent barriers that exist for any new disruptive technology – including awareness, credibility, application, financial reward, and regulatory policy. It is difficult to comprehend the enormous benefits when such a technology is still in its infancy. However, with focus and dedicated efforts, the significant benefits offered by these breakthroughs have been made available to the majority of the consumer public. How few people in the U.S. have not either surfed the Internet or used a wireless device for communications?

Sound government policy promotes the creation and adoption of new disruptive technologies while allowing the market to pick winners and losers among the competing technologies. Creative and flexible regulatory policy allows the market to accelerate the evaluation and approval of new technologies, provides for maximum flexibility, and subjects innovations to minimal regulation. Indeed, the Communications Act requires the FCC to "encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans."

The question then becomes: How can the FCC foster disruptive technology so that its benefits and new opportunities are offered to the public as rapidly as possible, and economic benefits can be gained by the industry? The best way to answer this question is to choose an example of a potentially disruptive technology that is in development today, and discuss ways to facilitate its evaluation and deployment.

Identifying a New Disruptive Technology

One of the most significant requirements facing the communications industry today is to meet the demand for broadband mobile data and multimedia services. The introduction of third generation (3G) networks represents an evolutionary, but dramatic, step in technology for meeting this global demand. At the same time, the convergence of voice, Internet, and mobile data business models are creating tremendous opportunities for mobile operators. Mobile broadband can also support advanced mobile services such as video conferencing, location-based services, and wireless enterprise applications. In recognition of the importance of this convergence, the FCC and Congress have embarked upon the course of encouraging the development of advanced technologies. However, despite these efforts, and the efforts of the broadband mobile data community, the industry has yet to achieve the collective objectives for these evolved networks. Moreover, this evolution also introduces complex challenges for both legacy mobile networks and new mobile data networks.

In addition, numerous risks are apparent – most particularly the risk of large investments in spectrum licenses and new network infrastructure. New business strategies, operational processes, IT architectures, and compelling applications are issues that also must be addressed.

Mobile ad hoc technology, currently in engineering trials, holds great promise of supporting 3G – and even 4G applications. Mobile ad hoc networks are self-forming/self-healing networks that are potentially an order of magnitude less expensive to deploy and maintain. And they offer higher sustainable data rates over a long distance than networks contemplated by 3G networks.

In keeping with sound spectrum policy and the goals of the FCC, ad hoc networks are spectrally efficient. The architecture of ad hoc networks dramatically improves frequency reuse when compared to traditional hierarchical network architectures. As broadband data rates increase, physics dictates a shorter transmission distance, making the cellular “star” network model unwieldy due to the need for two to three times the current number of cell sites. Ad hoc networks instead utilize very small routers and access points that are more numerous, but at only a very small fraction of the cost of a cell site. And having a distributed architecture eliminates the need for costly cellular towers, allowing for more economical service rates. This same architecture increases survivability and reliability by providing alternate routing and ease of network management.

In continuing the trend of merging the disruptive technologies of wireless communications and the Internet, ad hoc technology has countless uses and applications. In addition to broadband mobile data and multimedia services, this new technology potentially applies to telematics for the auto industry, last mile access for the residence, LAN/WAN for the enterprise, VPN networks for entertainment and gaming, and enhanced fixed wireless networks. Ad hoc peer-to-peer networks truly qualify as a disruptive technology.

A Need For Spectrum

The burden of successfully introducing and deploying a technology, like ad hoc peer-to-peer networks, remains with those who understand its potential impact on society and industry, and choose to support it. But despite the enormous effort and resources required to validate its credibility as a solution for the market, the ad hoc peer-to-peer vision will remain incomplete and unfulfilled absent direct and timely regulatory action.

Any new wireless technology requires spectrum and often, if successful, increasing amounts of spectrum. For example, the initial CMRS voice spectrum allocation has grown to 170 MHz, and the FCC is looking for ways to increase the amount of spectrum for these applications. As Europe and Asia have shown, the demand for mobile data spectrum can soon equal or exceed allocations for voice services.

Current allocations are structured primarily for wireless voice services. They are synchronous and symmetric in nature. Mobile data in comparison is asynchronous and asymmetric. The former is best suited to FDD schemes, the latter to TDD schemes that significantly reduce the amount of spectrum required. Mobile data services are being deployed today using cellular-type infrastructure and planning designed to share the voice spectrum. Inherently, mobile data services are, therefore, constrained to compatible cellular network architectures and evolved modem technologies. Any new allocations for mobile data service spectrum must be free of legacy technology and network encumbrances and must be allowed to use the best possible technologies available. These data services can operate on an integrated and compatible network with voice services, blending the networks at common access points. In fact, voice communications should be simply treated as one kind of data for the new digital network of the future – much as video, text, and other communications will be.

Significant additional capabilities must be added to the network infrastructure to follow the rapidly growing demand for data networks. New bandwidth-intensive applications in development for broadband mobile services will require more spectrum, putting even more pressure on demand for bandwidth. Using current technologies to meet anticipated mobile data service demands would require five to ten times the existing spectrum allocations – at a time when the FCC faces numerous other demands for spectrum for fixed wireless, satellite, government, and public safety uses. Therefore, new revolutionary technologies must be fostered – technologies that are much more efficient and significantly improve re-use and reduce the potential for interference.

There will always be competition for the spectrum allocated to mobile services, regardless of where the spectrum is located. However, the physics of RF communications dictate that the best frequencies for mobile services ranges from 500 MHz to 3 GHz, making this possibly the most coveted of all frequency bands. Regardless of the level of competition for prime mobile frequencies, the demand for additional mobile data frequencies where new, more efficient technologies can be deployed should be a national priority.

In addition to the current efforts to allocate additional 3G spectrum, at least two other spectrum bands present possible options for dedicated mobile data services: the 700 MHz bands that are being reallocated from broadcast services and the 2.5 GHz bands originally designated for MDS. Effective and efficient use of these bands for new mobile data would require changes to aggregated, non-channelized, block allocations open to new modulation schemes and network architectures. A technology that is essentially agnostic to any specific RF frequency and modulation scheme would be an ideal answer. This would leave the industry and market to determine the optimum solution set in terms of cost, performance, and service.

Clearly, Congress, the FCC, and NTIA have done much to provide for additional spectrum availability. Yet, without support for accelerating the process and identifying spectrum for new mobile data technologies, the promise of greater freedom in mobile connectivity and economic opportunity for the American people will continue to be delayed.

A Need For Packet-Based Technologies

With any emerging technology it is difficult to determine what will ultimately be its level of success. It is even more difficult in the mobile data industry because no single company can drive the industry by itself. Cooperation is required in the form of new partnerships among developers, government, carriers, and manufacturers. Adding to the quandary are new players to the industry such as utility and automotive companies. The result is a complex mixture of different technologies, divergent economic interests, and various competing strategies that must interact together and must converge to provide efficient and ubiquitous mobile broadband services. Add to this mixture the fact that Europe and Japan have led the world in developing and deploying mobile data services, and the result is that U. S. subscribers lag in the economic and social benefits from a national mobile broadband strategy.

The FCC has the opportunity to reverse these conditions by fostering the rapid deployment of revolutionary mobile data technologies. With the convergence of voice, data, and video communications inherent to digital technology – a bit is a bit is a bit – regulatory treatment of mobile data should not distinguish between the types of communication. A consistent regulatory focus will help speed national deployment of broadband wireless networks. Ad hoc technology embraces this consistent regulatory focus as it is a packet-based network, rather than the traditional circuit-based network for typical CMRS systems.

Ad hoc technologies perfectly match with the government's policy goal of ubiquitous broadband communications. They are designed to overlay several types of network architectures, including fixed, 802.11 LAN, personal mobile, residential access, and telematic networks. Fundamentally structured based on Internet protocols (IP) and packets, the Ad hoc network architecture can provide high capacity broadband mobile multimedia services through any enabled platform or device. By fostering a family of new service architectures such as ad hoc peer-to-peer, the U.S. can close the gap on the deployment of mobile data services and create networks that can take advantage of the new broadband applications awaiting implementation for the U.S. public.

As an example, ad hoc will allow for geo-location services accurate to less than 10 meters for any device or network utilizing the technology. This will open a plethora of new capabilities for public safety and location services. Because each platform or device contains it's own network management and capabilities, new billing models can be structured, not requiring a 'per packet' or 'per bit' billing model. Using the Internet as a model, a scalable and flexible ad hoc peer-to-peer network can expand to embrace new developments in the future and yet remain compatible and complimentary with legacy networks.

Expedited Timelines

Now, more than ever, the wireless communications industry needs to prove it can save money and improve efficiencies while rapidly deploying more capable broadband networks. As Chairman Powell has recognized, the current "command and control" and reactive policies of the FCC have slowed or even defeated the acceptance of creative innovations. For example, cellular technology was developed in the 1960s, spectrum allocation began in the 1970s, and cellular did not commercially launch service until the mid-1980s. Clearly today's fast-paced market environment - which operates on "Internet-time" – dictates that the FCC allow valuable, underutilized frequency bands to be cleared or re-designated more aggressively, while protecting critical national security and public welfare concerns. Acceleration of the introduction of new technologies can be supported by advance planning of spectrum allocations and policies to support future deployments.

Summary

Compelling disruptive technologies for mobile broadband networks may disrupt current business cases and perceptions of how we think of evolutionary upgrades to existing technologies, but these technologies can enhance the existing network infrastructures and the essential services provided through the networks. The public will gain the most when mobile data and multimedia services are delivered at significantly lower prices and with greater capabilities. It makes sense that providing Internet access to all citizens through networks designed specifically as an IP network, yet complimentary to existing traditional, evolved networks, is a solution worth the attention of both the government and the industry. It is even more important if the solution is adaptable to almost every public or private network, every device or platform, every IP application, and every multimedia service.

The FCC should seize the chance to foster these technologies and help propel America into the lead globally in mobile data communications. The FCC can do the following:

- Consistent with Chairman Powell's vision for spectrum management, develop a comprehensive and visionary spectrum plan for long term solutions that best serves the American public;

- Foster the deployment of compelling new technologies by:
  - Providing bidding credits to auction participants who will use new spectrum licenses for innovative or novel uses;
  - Encourage the deployment of new, disruptive technologies by setting aside spectrum strictly for experimental uses;
  - Continuing to build the technical capabilities of the FCC so that it may be an active participant in the encouragement of unique technologies.

- Accelerate the time necessary to implement new and re-designated spectrum allocations and associated policies.

By embracing these changes and encouraging the deployment of disruptive technologies, the FCC will enable its underlying goals of promoting an efficient, expeditious allocation of spectrum for use by the American public. By following through on the plans of Chairman Powell to identify and map allocations, service rules, licensees and users of spectrum and then creating policies for encouraging the reuse of the electromagnetic spectrum for disruptive technologies, the benefits and economic opportunities of such innovations will accrue to the American public.