Telecom Regulatory Authority of India
New Delhi

Overall Spectrum Management and Review of License Terms and Conditions

COMMENTS OF CISCO SYSTEMS, INC.

Cisco Systems, Inc. ("Cisco") welcomes the opportunity to offer its views on the consultation questions posed by the TRAI concerning spectrum management and license terms and conditions. As TRAI is well aware, spectrum is an extremely valuable resource and the explosive growth of wireless services is making spectrum even more valuable because of the benefits it can bring to the Indian people and economy.

TRAI's Consultation Paper on spectrum management asks very important questions about how best to ensure that this valuable resource is put to its best use. In its regulation of spectrum to date, TRAI has sought to ensure that operators only gain access to additional spectrum when market conditions demonstrate that they have an immediate need for the spectrum. Cisco submits that this approach will not serve India well going forward. Broadband networks literally need broad bands of spectrum. In fact, for wireless broadband networks, incremental spectrum awards will exponentially increase the cost of building networks since wireless broadband requires large spectrum blocks. Incremental awards are also unnecessary, given industry demand projections.

Cisco is a global technology and services company, headquartered in San Jose, California, USA with a large and growing campus in Bangalore that serves as our Globalisation Center East, a major research and development and product center. Cisco currently employs more than 5,000 people in India, including engineering staff that develops new technologies that Cisco sells worldwide. In late 2007, Cisco purchased Navini Networks, Inc., a Richardson, Texas, USA-based maker of WiMAX technology, also with a large engineering presence in Bangalore. Since our campus officially opened on October 30, 2007, construction of new buildings has advanced, and Cisco continues to build on its plan to make our staff in India a key part of our technology development initiatives. Cisco also supports 160 Networking Academies in India in cooperating with leading educational institutions throughout the country, and Cisco, together with its partners, has trained more than 75,000 students in IP-based networking technologies. In addition to our direct investment in India, Cisco has established valued partnerships with other companies that lead the Indian economy, such as Infosys, Wipro, Tata, and others. Our commitment to India, and to our Indian employees, partners, and customers remains strong, and we view our presence in India as an important part of Cisco's future success.

Explosive Growth of the Indian Telecom Market

As the TRAI's Consultation Paper demonstrates, India has experienced tremendous growth in demand for telecommunications services in recent years. The total subscriber base has increased from fewer than 40 million in 1997 to almost 430 million in

2009. Not surprisingly, as in developing countries around the world, virtually all of that growth has been in wireless, which, according to the Consultation Paper, accounts for approximately 392 million subscribers.[1]

Perhaps more important than the sheer number of subscribers, remarkable as that is, is the clear trend in growth in the industry. While the wireline sector has remained basically flat, wireless has been on a very steep and, indeed, accelerating growth curve. As a result, current demand projections forecast that the total wireless market in India will nearly triple in the next 6 years to more than 1.1 billion subscribers.[2]

TRAI notes that India will need to assure the availability of adequate spectrum in order to sustain this phenomenal growth.[3] But the projection of the likely number of subscribers in India is only the first step in appreciating how much spectrum must be available. Already, various kinds of data traffic greatly exceed the volume of voice traffic, both on wired and wireless networks.

The growth of global mobile data traffic will be extraordinary in the coming years. For example, Cisco estimates that:

- Global mobile data traffic will increase 66 times between 2008 and 2013;
- Global mobile data traffic will exceed two exabytes per month in 2013;[4]
- Mobile broadband will drive over 80% of mobile data traffic by 2013;
- Mobile data traffic will reach 1 exabyte in half the time it took fixed traffic to do so;
- Almost 64% of the world's mobile data traffic will be video by 2013;
- Video websites YouTube and Hulu currently generate twice the traffic of the entire Internet Backbone in 2000;
- Video will be nearly 50% of all traffic, fixed and mobile, by 2012;
- Business IP, fixed and mobile, will grow at a 35% Compound Annual Growth Rate between 2007 and 2012 to 10,000 petabytes (or 10 exabytes) per month.

In sum, two things are clear. The Indian wireless telecom market, like the global wireless telecom market, is growing rapidly and this growth is likely to continue for the foreseeable future. Also, increasingly the growth in global wireless traffic is in bandwidth intensive applications, particularly video. As a result of these two trends, India must allocate substantial amounts of new spectrum for commercial wireless telecom services.

Questions for Consultation

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[1] *Consultation Paper* at 4, Figure 1.
[2] *Consultation Paper* at 9-10, Table 2.
[3] *Consultation Paper* at 9.
[4] One exabyte equals one billion gigabytes.

The Consultation Paper asks many very important and complex questions. These comments focus primarily on the broader policy questions posed by the Consultation Paper, rather than specific operational issues, such as those related to licensing. Plainly, questions about how India should license wireless services are very important; but unless TRAI develops spectrum allocation regulations in a way that enables the industry to meet demand, the specific licensing rules will not matter – India's spectrum management policies will not succeed.

After discussing likely demand projections and related matters in Chapter 1, the Consultation Paper poses the following questions:

Spectrum requirement and availability

1. Do you agree with the subscriber base projections? If not, please provide the reasons for disagreement and your projection estimates along with their basis?
2. Do you agree with the spectrum requirement projected in ¶ 1.7 to ¶1.12? Please give your assessment (service-area wise).
3. How can the spectrum required for Telecommunication purposes and currently available with the Government agencies be re-farmed?
4. In view of the policy of technology and service neutrality licences, should any restriction be placed on these bands (800,900 and 1800 MHz) for providing a specific service and secondly, after the expiry of present licences, how will the spectrum in the 800/900 MHz band be assigned to the operators?
5. How and when should spectrum in 700 MHz band be allocated between competitive services?
6. What is the impact of digital dividend on 3G and BWA?

<u>Subscriber Projections</u>

Do you agree with the subscriber base projections? If not, please provide the reasons for disagreement and your projection estimates along with their basis?

Obviously, it is impossible to predict future demand precisely, but the subscriber projections in the Consultation Paper appear reasonable and reasonably likely to be fulfilled. First, the projections are consistent with the trend in subscriber growth that India has experienced in recent years. Moreover, this rapid growth is also consistent with growth rates that have been experienced in other developing countries, including in developing countries that have significantly lower per capita GDP and much smaller middle and professional classes. In addition, as mobile devices become less expensive, they become affordable for even wider segments of society. This has been true worldwide. At the same time, mobile telecom services and applications are becoming increasingly indispensible to more and more people. Therefore, it is quite reasonable to expect that India will have more than one billion mobile telecom subscribers by 2014.

Spectrum Requirements

Do you agree with the spectrum requirement projected in ¶ 1.7 to ¶1.12? Please give your assessment (service-area wise).

Based on the demand projections discussed above, it is clear that India will need very large amounts of spectrum for wireless telecom services in the next five years. The Consultation Paper attempts to estimate the amount of spectrum that will be needed in Delhi, India's largest telecom market, and concludes that for the anticipated 34.9 million mobile subscribers in 2014, operators will need 274 MHz for 2G services alone. This includes 2x100 MHz for GSM operators, and 2x37MHz for CDMA operators. TRAI estimates that five 3G operators will need an additional 100 MHz of spectrum by 2014.[5] Five Broadband Wireless Access (BWA) operators will also require 100 MHz of spectrum, TRAI estimates, and Mobile TV, Digital Terrestrial TV, and LTE will all be competing for spectrum in the 700 MHz band. TRAI estimates that 108 MHz can be allocated in the 700 MHz band for these services. In all, TRAI estimates that, in Delhi, commercial mobile services will require approximately 582 MHz of spectrum by 2014.[6]

This is a very large amount of spectrum. However, based on demand projections and the technologies that will be deployed to meet growing demand, this estimate of 582 MHz of spectrum will be less than what is needed. As one example, BWA operators will need at least 30 MHz of spectrum in order to deploy a commercially viable system, and much more spectrum will be required for deployments that serve dense urban areas. These systems, whether based on LTE, WiMAX, or another technology, require large channels of 5, 10, or even 20 MHz in order to provide sufficient throughput for current and future broadband applications. Therefore, in order to be commercially viable and to efficiently reuse spectrum in its network, a BWA operator will need at least 30 MHz of contiguous spectrum. BWA operators in other parts of the world have access to even more spectrum. For example, in the United States, Clearwire has between 100 and 150 MHz of spectrum in most major U.S. markets. In Russia, Yota has up to 40 MHz of spectrum in its markets. If India licenses five operators in a market like Delhi, then this service alone will require between 150 and 300 MHz of spectrum or more.

Spectrum Refarming

How can the spectrum required for Telecommunication purposes and currently available with the Government agencies be re-farmed?

The Consultation Paper lays out some very reasonable principles concerning spectrum refarming. Governments allocated spectrum for a variety of services, both commercial and governmental, many years ago, before the explosive growth in demand for commercial wireless services. Today, that spectrum is a very valuable resource, and it is

5 *Consultation Paper* at 11.
6 *Consultation Paper* at 12.

incumbent upon policy makers to ensure that it is being used efficiently. This applies both to government and commercial spectrum users.

Where possible, government services that can be made more spectrally efficient should reallocate some of that spectrum to commercial purposes. This will likely impose significant costs on the government users due to the need to purchase new radio systems. In many cases, however, government users would need to replace existing equipment in any case, and can now replace old, outmoded equipment with newer, more efficient, and more technically robust equipment. Auction revenues are a good source of funding for the relocation of government users.

This approach is consistent with the Indian Governments 1999 National Telecommunications Policy, as quoted by the Consultation Paper.[7] Thus, refarming of government spectrum for commercial use does not appear to require any change in the policy of the Government of India. TRAI and the Department of Telecommunications should undertake a comprehensive audit of spectrum use in both the government and commercial sectors to determine where spectrum can be used more efficiently and what spectrum can be refarmed to meet the rapidly growing demand for commercial wireless services.

Use of Spectrum in 800 MHz and 900 MHz Bands

In view of the policy of technology and service neutrality licences, should any restriction be placed on these bands (800,900 and 1800 MHz) for providing a specific service and secondly, after the expiry of present licences, how will the spectrum in the 800/900 MHz band be assigned to the operators?

In essence, TRAI is asking whether current licensees should be permitted to refarm the spectrum that they are now using for mobile voice services and how this spectrum should be used at the end of current licenses.

Cisco believes that a flexible, light regulatory touch will best serve India's interests. In particular, current GSM licensees should be permitted to use any technology they choose and provide any service that they believe customers want using their current spectrum in the 800, 900, and 1800 MHz bands, subject of course to any quality of service requirements contained in the licenses. Cisco is not familiar with the terms of India's licenses in these bands, but some governments have imposed overly restrictive requirements in wireless licenses, such as mandating a particular technical standard or prohibiting licensees from providing advanced services.

Such an approach will not allow existing operators to respond to consumer demand. As we have noted above, not only will demand continue to grow dramatically in coming years, but the nature of traffic will continue to shift from voice to data and within the category of data traffic to more and more bandwidth intensive applications, particularly video. Operators should be given the regulatory flexibility to respond to these shifts and to meet consumer demand.

7 *Consultation Paper* at 17.

If, as current licenses expire, TRAI revisits the issue of how the spectrum in these bands is to be used and how it should be licensed, Cisco again recommends a flexible, light handed approach. At that time it will also be important to consider whether each operator has sufficient contiguous spectrum to provide the broadband services that consumers demand.

700 MHz Band

How and when should spectrum in 700 MHz band be allocated between competitive services?

As the foregoing discussion demonstrates, India, like countries around the world, will have a pressing need for additional spectrum for broadband wireless services. India should therefore allocate spectrum in the 700 MHz band as soon as possible. There will no doubt be competing demands for this very valuable spectrum. As we have previously noted, wireless broadband traffic is increasingly weighted toward video. Broadband wireless licensees will need large blocks of contiguous spectrum, at least 30 MHz per licensee. TRAI should factor this in when deciding whether to allocate spectrum in the 700 MHz band to terrestrial digital television.

Digital Dividend

What is the impact of digital dividend on 3G and BWA?

As the Consultation Paper suggests, India has an opportunity to use the 700 MHz band to greatly expand the amount of spectrum available for broadband services by allocating this band for 3G, BWA, or another emerging commercial wireless technology and India is, indeed, fortunate that this band is largely available already. Because of the propagation characteristics of this band, operators can construct networks in the 700 MHz band much more efficiently than in higher frequency bands. In addition, because this spectrum is already available in India – because it has not been used for analog television – India's path to allocating this spectrum for broadband wireless services will be much less complicated than it has been in North America and Europe.

Spectrum Sharing

Should Spectrum sharing be allowed? If yes, what should be the regulatory framework for allowing spectrum sharing among the service providers?

The Consultation Paper discusses a variety of regulatory schemes for sharing spectrum.[8] Plainly, as demand for service continues to grow, various methods of sharing spectrum will be essential as demand exceeds the supply of spectrum, especially below 3 GHz. Therefore, spectrum sharing should definitely be allowed. Beyond the type of temporary arrangements between operators discussed in the Consultation Paper, however, improvements in technology allow multiple operators to share spectrum. Not only is radio technology better than in the past, but software-defined radios can be fine-tuned to address band-specific conditions.

[8] *Consultation Paper* at 46-49.

An excellent example of this form of sharing is the use of wireless LAN technology in bands currently occupied by government radars at 5 GHz. Unlicensed devices used in this band can share the spectrum with government radars by moving off of the frequencies being used by radars. Both the European Telecommunications Standards Institute (ETSI) and the US Federal Communications Commission (FCC) have developed technical standards to allow such sharing. This spectrum can help India to extend low cost shared WiFi access throughout the country, particularly to underserved rural areas.

Similarly, Radio Local Area Networks (RLAN) can bring broadband to rural areas and are already being used to do so in a number of countries. Unfortunately, current regulations in India do not permit the most optimal products to be deployed to meet rural broadband needs. RLANs, commonly known as Wi-Fi (a registered trademark of the Wi-Fi Alliance www.wi-fi.org), use license-exempt spectrum to deliver high-speed wireless broadband access to stand-alone access points ("hot spots") or networked access points ("mesh networks"). A less well-known, but highly important use of the technology is to deliver high-speed point-to-point links over longer distances (e.g., up to 20 kilometers) that can be used to deliver traffic to and from remote locations at a much lower cost than wired connections.

Wi-Fi systems are the lowest cost broadband solution and are supported by a large, global vendor community that competes both on price and on innovation. In fact, the speed of innovation for Wi-Fi solutions generally outpaces other wireless technologies. In addition to new client devices supporting new uses, the most recent Wi-Fi technology can today support throughput speeds of up to 250Mbps; with the aid of special antennas such speeds can be delivered over a distance of several kilometers. These networks can provide voice, data, and video in a wide range of indoor and outdoor networks, and can be deployed by residential end users, by businesses as a tool for their employees or customers, and by service providers using state-of-the-art networking techniques like wireless bridges and wireless mesh networks.

As discussed above, the technology also supports point-to-point connectivity. Cisco is maintaining a POC site in Chennai showcasing point-to-point and point-to-multipoint bridging links ranging from 2-12 kilometers in the heart of the city (although longer distances are possible in rural settings). Applications like voice and video are successfully running over those links.

Because of current regulations, India is denying itself the full benefits of Wi-Fi technologies. Cisco recommends the following changes.

First, India needs to open the band 5470-5725 MHz for unlicensed Wi-Fi use, both indoor and outdoor. In addition, India should revise its regulations to allow outdoor use in the band 5725-5875 MHz (currently outdoor use is allowed only between 5825 and 5875 MHz). India should also conform its regulations to the maximum transmitter power and maximum E.I.R.P. permitted by ITU regulations. These changes, which would harmonize India's regulations with international best practices, are summarized in the following table:

Spectrum bands	Maximum transmitter power	Maximum E.I.R.P.	De-licensed uses & conditions
5470 – 5725 MHz NEW[9]	Maximum mean power of 250mW (24dBm) and maximum mean power density of 50 mW/MHz	1W (30 dBm)	Indoor or outdoor; dynamic frequency selection and transmit power control (or equivalent) required[10]
5725 – 5875 MHz REVISED[11]	1W in spread of 10 MHz or higher	4W (36 dBm)[12]	Indoor and outdoor

[9] The WRC 2003 proceedings limited maximum EIRP to 1W for this band, maximum transmitter power to 250 mW, with the maximum power density of 50mW/MHz.

[10] Recent joint work by ETSI and the EUMETNET organization has resulted in updated requirements for the protection of weather radars operating in the 5600-5650 MHz range. The Indian government would be well advised to adopt the latest ETSI specification (EN 301-893-1.5.1) for DFS compliance testing of RLAN devices operating in this band once this is officially published early in 2009.

[11] The current band plan does not harmonize with the rest of the world in that outdoor unlicensed use does not extend down to 5.725 GHz, and as a result, India is not able to take advantage of the band to achieve its broadband objectives. Lack of harmonization has significant consequences, including the inability to take advantage of global scale economies in equipment that produce the best-performance at the lowest cost and the inability to harness innovation spurred by the global competitive market. Today the 5.825-5.875 GHz band is significantly underutilized due to reluctance by manufacturers to produce equipment for a single national market because such production is expensive. Harmonization is needed in order for India to take full advantage of this band.

[12] In addition, India should consider an alternative rule for the 5.7-5.8 GHz band that would enable high power fixed point-to-point communications links. The text of the FCC rule is illustrative. Section 15.407(a)(3) of the FCC's rules states, in pertinent part): "Fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for

In addition, India has not yet fully de-licensed Wi-Fi bands. In the last five years, the Department of Transportation has issued a series of decisions that de-licensed specific RLAN operations, which is a very positive development. Nevertheless, India should go further and de-license outdoor operations at 2.4 GHz and from 5.725- 5.875 GHz, and when spectrum is opened at 5.4 – 5.7 GHz, to de-license outdoor use in that band, as well. Licensing requirements greatly increase the cost and complexity of utilizing the latest innovations in RLAN "mesh" technology to cover broad areas of cities. An outdoor mesh deployment can consist of thousands of access points, each of which would need to have its own transmitter license. Any physical adjustment of locations would then require the operator – and regulator – to update license files. This regime is entirely unnecessary, given the power levels and the robust nature of the technology to deliver packets in an unmanaged spectrum environment. Simply put, RLAN technology has been designed to work in a de-licensed band, using contention-based protocols that ensure the delivery of packets even in an environment where multiple unlicensed users are competing for the use of a frequency.

If India fails to make these recommended modifications to its licensing and regulatory regime, India will be unable to take advantage of numerous products developed under the IEEE 802.11a standard and its recent amendments (e.g. 11n for MIMO/Beamforming) for point-to-point and point-to-multipoint uses. Equipment developed for these frequencies provides for very fast broadband speeds exceeding 100 megabits per second. However, because these technologies operate below 5725 MHz, they cannot be used in India today. Yet, these are the very technologies that can be of greatest assistance to delivering broadband to rural areas of the country. India should take steps to join the European Union, United States, Canada, and many other jurisdictions in opening up the 5470-5725 MHz band to use by unlicensed devices that can avoid radar systems. This technology, known as "dynamic frequency selection" is well-proven and in widespread use.

Similarly, IEEE 802.11a equipment that utilizes spectrum from 5725 to 5875 MHz cannot be meaningfully used in India, because the equipment is channelized for global markets, and not for India's outdoor 5825 – 5875 MHz band. In order to reap the benefits of these technologies, India will have to extend outdoor and de-licensed use of equipment to the 5725 to 5825 MHz.

Of course, licensed service provider networks will continue to expand to offer increasingly robust broadband throughout India. At the same time, however, the Government should not ignore the role that unlicensed Wi-Fi technologies can play in making broadband available to every home and business in India. The benefits of Wi-Fi include very high performance, security and reliability at very low cost. In fact the two technologies – licensed and unlicensed – are complementary. Licensed wireless services

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ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations."

provide ubiquitous access from mobile devices at data rates of a few megabits/second and distances of a few kilometers. The higher cost of the equipment and backhaul networks assures a high level of service assurance, which can be critical in urban business and residential areas.

In contrast, Wi-Fi based rural networks that consist of Wi-Fi long distance links connecting remote access points that serve local computers can provide tens of megabits/second throughput over tens of kilometers and provide highly efficient data services with a capability to support voice and data services. Wi-Fi technology comes with a trade-off: The lower cost of the Wi-Fi equipment comes at the price of a reduced level of service assurance. Moreover, as the number of Wi-Fi devices in a given area grows, the throughput per device drops. In rural areas, however, this is less of a concern because the number of simultaneous users will be far lower than in urban areas.

Cisco urges the government of India to consider revising and updating its regulations for Wi-Fi devices to take full advantage of the commercial technology available to serve rural populations. The low cost of Wi-Fi is a tremendously important tool in delivering low-cost broadband to rural areas.

Spectrum Assignment

Question 48 of the Consultation Paper asks:

Should the spectrum be assigned in tranches of 1 MHz for GSM technology: What is the optimum tranche for assignment?

As we have noted repeatedly, broadband networks require large blocks of contiguous spectrum. This is true by the nature of the technologies, which are being designed to use channels of 5, 10, and even 20 MHz. And the technology is being driven by the applications that these new networks are carrying – such as video. Larger blocks of spectrum allow operators to efficiently engineer their networks.

In contrast, if India only grants operators additional spectrum incrementally and in small blocks (such as in increments of one MHz at a time) operators will be unable to plan their networks efficiently and will have to constantly re-engineer. Moreover, there is a related problem: regulators around the world are assigning large blocks of spectrum to operators, which allows operators to use sufficiently wide channels to provide maximum throughput to end users. As a result, equipment vendors around the world are designing equipment to operate on these broadband networks. The industry is creating a de facto standard. If India departs from this global best practice, and only assigns additional spectrum in small increments, Indian operators will have to work with vendors to develop equipment to meet the unique characteristics of Indian networks. This will dramatically increase the cost of equipment for Indian operators and will either increase the cost of new networks in India or slow their deployment, or both. Given India's rapidly growing demand for wireless service, and its current low level of broadband penetration, this policy would not serve the interests of Indian consumers or operators.

Cisco recommends that TRAI abandon the use of Subscriber Linked Criteria (SLC) for the allocation of additional spectrum. The motivation for this policy is understandable and laudable – given the very high value of commercial wireless spectrum, regulators do not want to give spectrum to operators that cannot or will not use it. But given the astonishing growth in the Indian telecom market, this problem – known as spectrum warehousing – is not what TRAI needs to be concerned about. Rather, the very real emergency confronting TRAI is that operators lack sufficient spectrum to meet the consumer demand. Indeed, TRAI can predict with confidence that all operators will need additional spectrum, and that they will need to have access to large blocks of additional spectrum. Therefore, TRAI should not wait until operators are spectrum-constrained before assigning additional spectrum. Rather, TRAI should act now to ensure that operators are able to engineer their networks efficiently to meet the burgeoning demand. Using an SLC to assign additional spectrum will make it impossible for operators to engineer their networks efficiently and, especially if spectrum is assigned one MHz at a time, will likely make it impossible for operators to provide high bandwidth applications.

Spectrum Management

Question 57 of the Consultation Paper asks:

What in your opinion is the desired structure for efficient management of spectrum?

In addition to allocating large blocks of spectrum, Cisco recommends two further policies.

First, TRAI should eliminate any licensing conditions that limit the services that operators may provide. Thus, if TRAI abandons the SLC approach to awarding additional spectrum and eliminates restrictions on the services licensees can provide, current GSM licensees, for example, could gain access to significant amounts of additional spectrum and use that spectrum to offer both voice and data services. BWA licensees likewise would be free to provide both data and voice services as well. This approach will primarily benefit consumers because the competitive market that TRAI has fostered in India will force operators to put their licensed spectrum to its highest and best use.

Second, TRAI should also avoid imposing any technology mandates on operators. That is, operators should be free to migrate their networks to new technologies if that will best meet the needs of their customers.

If TRAI remains concerned that operators will attempt to warehouse spectrum, then the use of spectrum auctions for assigning spectrum is likely to be more effective in preventing this than the SLC. Further, by assigning the large blocks of spectrum that will be needed to meet demand now, TRAI will allow operators to plan their networks intelligently and efficiently and thus to reduce the cost of providing service.

Finally, as with all regulatory exercises, spectrum management should be transparent and allow operators and vendors to envision their likely future growth plans. In this context, transparency requires soliciting the views of affected stakeholders – including not only operators and vendors, but of course consumers – as to marketplace needs and technical solutions to meet those needs. Spectrum management always entails balancing competing interests, and thus transparent spectrum management also requires the Government to explain clearly the choices that it is making. Transparency will improve the quality of spectrum management decisions, and will also assure stakeholders that their interests have been given full consideration in the regulatory process.

Conclusion

Demand for wireless services is growing explosively around the world and especially in India. As the number of subscribers continues to grow, and they demand more and more bandwidth intensive applications, TRAI will need to allocate substantial amounts of new spectrum.

Cisco commends TRAI for recognizing the pressing need to allocate additional services to meet rapidly growing and changing demand. The Consultation Paper asks very important questions about how TRAI can best accomplish this. Cisco appreciates the opportunity to share its views on these important issues and stands ready to work with TRAI and other stakeholders to continue to move these issues forward.

Respectfully submitted,

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