Standing Committee on Communications, Information Technology and the Arts

inquiry into

Wireless Broadband Technologies

Joint submission
by
Users of Wireless Networking Technologies

This submission is co-authored by various affiliated and non-affiliated wireless networking enthusiasts from around Australia. We feel the need to contribute under our own aegis, as individuals working collectively to provide networking services to the community. In this spirit we humbly submit this collective document as a representative sample of the views of many participants within the national wireless community. In addition we humbly petition the honorable members for an opportunity to appear before them and further explain our views, and to note that members live in a variety of cities and are able for a variety of hearings.

Contents

Pretenses

This submission deals with proposed community usage of 802.11 devices in the 2.4GHz ISM band, to deliver content on a not-for-profit basis for outdoor usage over distances exceeding 500m. We also make acknowledgments of commercial use of this space as well.

About wireless communities

Wireless community networks have been operating worldwide for more than a decade. From rural Colorado to Mongolia, from Canberra to Slovenia, Ottawa to the Alps, individuals are using digital radio devices to link up with other like minded people, forming wireless groups. These groups grow and provide valuable services to their local community at low cost (indeed, often at no cost). It is an example of community level philanthropy in action.

In recent times, the arrival on the market of cheap, PCMCIA-based wireless cards for short-range communication has been a driving force behind the adoption of 802.11b technology in the home and in institutional settings. By working co-operatively, wireless communities aim to leverage the capabilities of these networks to cover wider areas, and even entire cities.

Wireless communities do not seek to replace Internet Service Providers, or even augment existing Internet Service Providers, just as local swimming pools do not seek to replace the ocean. While there are similarities in method of operation and technical protocols employed, they serve the community internally, rather than linking the community to the "outside" world as Internet Service Providers do.

The goals and aims of a community network are as follows:

- ✍ to connect the community at a community level, amongst and across regional and metropolitan areas as ubiquitously as possible
- ✍ to promote community use and development of this networking infrastructure

and to leverage intra-community connectivity to enhance the quality of life of those residing and working in the areas covered.

The specific advantages of a fully developed community wireless network are as follows:

- ✍ Community management and involvement
- ✍ Low entry and recurring costs
- ✍ Relatively high bandwidth and low latency
- ✍ Regional ubiquity
- ✍ Localised delivery of content and services

Groups of individuals are helping themselves and their community, by building networks using inexpensive and readily available equipment. These 802.11b (or Wi-Fi standard) components do not require any special technical expertise to setup and use. As more and more people become connected, the network will develop from a connection of isolated wireless "islands", into regions of connectivity, where these islands overlap and merge. Anyone entering that space with appropriate equipment (ie a home PC and an 802.11b wireless card) will be able to connect. Eventually these regions will overlap and span entire towns, cities, and regional centers. Any person in these regions who chooses to participate will then have access.

The community wireless movement is comprised of a broad cross section of the community. In our number we can count IT professionals, radio and telecommunication engineers, students, community sector workers, company directors, network developers, unemployed, retired and disabled people, small media publishers, artists and musicians, and people from the film and video industry. This represents a substantial skills base, both in technical and organisational terms, and an extensive range of links with the wider community.

The philosophy of wireless communities is not that of a commercial customer service relationship. Rather it is a self-help movement, working together to provide connectivity as ubiquitously as possible within and to the local community, fulfilling the needs of citizens to connect to the community at large. There is an expectation that early adopters will bring their own skills and experience to the table, and contribute to the growth and upkeep of the network. As the network matures, this need will reduce. Already most community networks freely allow connections from casual and occasional users, in as far as such is allowed under the existing legislation.

In addition, wireless communities seek to bridge the digital divide, by extending access and support to those in society who might not otherwise have access to networking facilities of any kind, let alone broadband.

Over 2500 people, from all Australian capital cities and many regional centers, have shown interest in wireless networking at a community, non-profit level. This momentum has been achieved with little to no publicity and complete private funding thus far.

To date there has been no focused or targeted advertising or publicity, beyond general newspaper articles and mentions on various websites around the globe, about Australian and world wide issues in regards to these technologies.

There are many thousands more dedicated to achieving similar goals in other countries. We expect that this movement will build into a strong, national and international, wireless community presence.

From here we believe it will then draw steadily closer to our goal of full ubiquity in areas where sufficient interest exists or can be generated.

Current Issues at hand

Wireless community users seek to address some of the limitations with existing broadband implementations. These limitations typically exist for very good technical and business reasons. Often these limitations act to straitjacket users because existing broadband is being asked to do something that it cannot do very well. These limitations include:

- Excess charges, even on data that may only go down the street, levied by the broadband providers
- Restrictions to freedom in what can be done with a broadband connection
- Limitations to the use of the services offered by broadband companies

Whilst not impossible, it has been shown to be difficult for the major telecommunications carriers to separate local data traffic. The current situation is similar to charging international postage rates for mail delivery within the same street.

Currently most broadband contracts limit the rights of users to provide local services. All traffic must be routed through the central facilities of the provider, whether that traffic's destination is local or international, and is normally charged identically in either case.

Broadband ISP's provide valuable services, but they are not targeted at the community level. To do so would almost require that they partition their users, something which would reduce their utility.

Local wireless networks provide a method for offloading some of this local traffic and local service provision from ISP's to the community itself. ISP's are still required to provide their traditional large scale, national and international connectivity.

We also feel that 802.11b and similar technology will result in the provision of a wide range of as yet unimagined services across Australia. Some of these possible services are outlined in the section "Examples of existing and future community benefit".

Due to the ease of acquiring wireless devices and widespread enthusiasm for it, community wireless networks have sprung up even in the face of ambiguous legislation and the possible consequences of this. These wireless networks are beginning to span cities using nothing more than the resources hobbyists can obtain, and some hard work. It would be difficult to put this genie back in the bottle. It is far better that government do what it can to assist the existing movement in the responsible use of the available spectrum than force use of this spectrum underground. Wireless communities work hard to inform themselves of their legal responsibilities in use of this shared band, and to share that information with their members, and are an ideal forum for promoting self-regulation.

The 2.4GHz ISM band is currently used for a multitude of devices, from wireless networking to cordless phones and kitchen appliances (microwave ovens) to welding equipment. It is internationally agreed that this band be set aside for such uses. Due to this, it is unlikely to prove to be reliable for large scale, point to multi-point transmissions. However, since community use generally consists of short range transmitters linked by point-to point links, this problem can be minimised.

This does not make it unsuited to rural and non metropolitan areas, but, due to the nature of the technology, it is more suited to smaller areas. However, the lower number of sources of interference in less populated areas could mitigate this somewhat. Because a community based network could consist of as few as two interested parties, even the most sparsely populated areas could benefit. However to link these networks together would rely on a suitable carrier network, which may well be impossible to justify.

If used as a last mile solution, commercial operators wishing to provide a highly reliable service would need to deal with sources of interference which are, for the most part, beyond their control, and which they have no right, in a public band, to attempt to control. Users in this band have to accept a degree of interference, both from each other and from other ISM devices. Where competition for this spectrum exists, mutual interference could quite easily lead to a situation where each operator would be forced to increase the density of access points to an uneconomic level and/or increase power to (or beyond) the legal and/or sustainable limit. This would be an inherently self-defeating situation.

A recent news item on CNN (http://www.cnn.com/2002/TECH/ptech/06/02/wireless.crowding.ap/index.html) clearly illustrates the potential problems associated with using WLAN and class license devices for "last mile" links. The problems listed in this article were purely to do with indoor usage, which makes the issue even more problematic in regional networks, where one does not have the walls of a building to help reduce interference.

While we are enthusiastic about wireless for "Last Mile Links", we feel commercial "last mile" operators should have access to a more regulated area of spectrum. Last mile service requires high reliability and some measure of security.

We have no objection to commercial use of the ISM band, where commercial operators are willing to live with the limitations of a public band, and we intend to set up close working relationships with those operators wherever possible. We would however strenuously object to any attempt to privatise the commons, and close out community operators. A parallel might be made to an attempt by commercial operators to use another public band, such as the the CB (citizen's band) spectrum, to provide commercial service, and then to agitate for further control over that band. We believe it is in the national interest to retain a publicly accessible band for such applications as may not be economic in a commercial setting.

The commercial imperatives under which businesses operate generally preclude the long-term provision of loss making services or facilities. Numerous community groups around the world have been developing strategies for over a decade, to enable the community to work with the services offered by traditional telecommunications companies to deliver a richer and more rewarding experience. Person-to-person, person to group, narrow, wide, and multi broadcast of rich media is possible using currently available technology. This enables the community to leverage the enormous diversity within it to produce richer and more widespread involvement.

Given that the FCC allocation of 802.11 spectrum was initially prompted by the Apple NII "Supernet" proposal in 1994, and given that the class license as specified by the AWA specifically refers the reader to FCC specifications in it's own definition, it is surprising that government has stood by and allowed commercial operators to attempt to deploy services in this spectrum. 802.11 operation was designed, from the outset, to promote and support grass-roots networking, in the eventual hope that city-wide and larger wireless mesh networks would be erected by the public, with the ultimate goal of global broadband connectivity.

It is felt by the supporters of this submission, as active members of the grass-roots community networking movement, that the aggressive entry of commercial operators into this field creates a danger of gradual erosion of the grass-roots community, as corporations pursue their profit margin, either through the courts or via lobbying of government.

To this end we would like the government to regulate commercial use of this spectrum, to prevent the co-option of public spectrum by commercial use. This will preserve the interests of other stakeholders such as local authorities, community and amateur organisations, and groups of interested individuals. Commercial use of this bandwidth should be undertaken only if there is to be no adverse affect on the non-commercial operators.

Preservation of the public use of this radio spectrum must be paramount, given that all other available spectrum is either reserved for government use, or has been auctioned off to the highest bidder. There is no other spectrum available for grass-roots community broadband development. We feel that unless there is some government regulation of commercial entities, the end result could be very small, splintered community involvement, whereas there is currently a huge surge of interest throughout Australia. This can only be expected to grow, given the current novelty of the technology and the resultant general lack of public awareness.

The future

Modern multicasting protocols make it easy to send information (an email, streaming live coverage of a parade, sporting event, school concert performance or gardening lecture) to multiple recipients simultaneously, up to and including the entire network. It becomes apparent that the possible uses of such a network are limited only by the energy and creative potential of the community it covers. In some communities, such as any of the cities, both regional and capital, throughout the nation, such potential is very high indeed.

The possibilities are endless. Health information provided by the local hospitals, community medical center or even one's local doctor and/or pharmacist; local sporting groups providing live streams of sporting fixtures; extremely focused media events (community/folk group performances, plays, foreign language news broadcasts delivered to a local ethnic community, etc). Some of the services we expect will be extremely attractive include person-to-person communications, such as voice-over-IP, chat services, email and voice and video-mail, and localised news services.

While most wireless groups in Australia are currently in the fledgling stage of deployment, there is common agreement between us all that we should not be overlooked in the scheme of things, as we too can and will as time passes, contribute significantly to the social benefits of digital communication in Australia, not to mention the potential large pool of wireless-savvy people, that are able to then take this technology and knowledge out to the rest of the world.

This is particularly compelling in the light of the recent creation of the "Virtual Colombo Plan", a partnership between the Australian government and the World Bank, using Australian expertise to export distance education to developing nations. Local 802.11b deployment in these regions would be a powerful distribution method for such projects, and it would be very much in the national interest to have a pool of interested and knowledgeable individuals available for such efforts.

As these networks are still in the developmental stage in Australia, it is difficult to speculate too accurately as to what use the community will make of such a network, once it has been made available to them. However we feel confident that any community provided with a free, ubiquitous, wireless network will use it to rapidly provide an extremely rich and diverse spectrum of services, facilities and uses.

It is predicted that groups which have already developed a strong local community, such as sporting clubs, religious and cultural groups, historical and other special-interest societies, will leap at the opportunity to easily connect to their members outside of their physical meeting place.

Wireless communities will work closely with other community groups for two reasons:

1 the operators are members of the community themselves, and are likely to be participants in other groups and local organisations
2 and for mutual benefit, in terms of exchange of both material and practical support.

Such co-operation could include the provision by the wireless community of networking support and training to other stakeholders, and the provision of training, support, content and location facilities by such groups to the wireless community. Suggestions to date have included working with churches, the Scouting movement, small businesses, charities, internet service providers, online content providers, computer gaming venues, local government agencies, sporting groups, community centers and neighborhood associations, non-government organisations, both national and international, primary and high schools, TAFE's and universities.

Cultural associations such as musical, art, and dance groups could benefit enormously from this technology, through provision of narrowly-targeted transmissions of cultural material for interest groups who are, otherwise, under-represented in available media channels, if represented at all.

Some wireless communities are currently moving towards, or debating the merits of, incorporating as associations or other formal groups. Some operators favor this, and others are diametrically opposed, preferring to work together as a loose affiliation of individuals sharing common protocols and exchanging data. In some ways this duplicates the anarchistic but co-operative nature of the internet, which is ultimately democratic. The internal organisation of each group is of little concern to anyone outside of each group, and is beyond the scope of this submission, except in so far as it intersects with our concerns about provisions in the Telecommunications Act. Suffice to say that a strong spirit of intergroup communication and co-operation exists despite these differences.

Even in those wireless communities which choose to remain loosely affiliated, the necessity of providing and using common technical protocols for interconnection provides a powerful means of self-regulation by which recalcitrant operators can be ostracized. As co-operative users of a common medium, we have a vested interest in promoting responsible use.

The debates about structure are driven in part by concerns of liability vs. individual responsibility. Whilst as individual or associated operators, we take full responsibility for our own activities and behavior, we have no way of controlling what others may do in an open environment.

The other main issue in this debate is the concern over perceived ambiguities in the Telecommunications Act 1997 covering non-commercial wireless service, and conflicting advice received by the wireless movement regarding permitted services. Obviously none of the volunteer wireless groups are prepared to become a carrier, as defined by current legislation. This is our largest potential legal stumbling block. Whereas other issues (such as restrictions on carrying commercial traffic) may restrict content, this concern has the potential to make community access seem too dangerous for individuals to contemplate. We outline those concerns for your consideration in the section of this submission titled "Recommendations".

The wireless community movement does not see itself as a competitor in the commercial internet delivery market. When one examines the capabilities of this technology, it becomes immediately apparent that it is best suited to short-range, internal connections within and across a city, and is not effective for technical and cost reasons, for longer range, inter-city communications.

However, there may be some "leakage" of internet connectivity to a community wireless networks. Primarily this may occur if an operator maintains a web site. This operator may also choose to publish it to the wireless network. In addition, individual users may wish to mirror content of special interest to them, or provide email services. Other technical issues include the sharing of proxy caches and the like. We feel it is important that people are not restricted from providing such information and services, and assert that such use is distinct from providing an internet delivery service.

The difference lies in a somewhat fuzzy line that separates what someone is willing to give to the community (perhaps with cost recovery through sponsorship or donation) and something someone does because they're paid to do it. At this point we're particularly glad we don't have to write legislation.

In preparing this submission we have done our share of speculation. It is highly likely that actual usage of such a network be far different from what we describe in this document. Some contributors to this document remember when 300 baud modems were considered state of the art. What we do today could not be envisaged then, but it is largely the person-to-person applications of available technologies, rather than their technical capacity, that bring about new developments.

Whilst it may be true that the early adopters could be described as geeks, the example of the internet shows that interest is not limited to technology buffs or those who would play computer games. In common with the internet, most of us who run, or intend to run, publicly accessible community wireless networks do so without regard for what people will do with them, provided that it is legal, does not compromise the network, nor interfere with how others choose to use it.

New applications will develop as people provide services, information or other commodities across the "Intranet Cloud". Given a sufficiently secure infrastructure this may well eventually become a useful and perhaps significant part of the Australian economy. Local merchants who find it prohibitive to advertise to the local community now have another avenue to attempt to market their products, while the potential for local trading, local aggregation for delivery or discounting purposes is largely unexplored.

Many services are trivial to set up. For instance a community group could simply share the ability to read a folder of electronic documents that may describe their constitution, practices, minutes, and events, among other things. More sophisticated services may require some familiarity with tools which can create web pages, but this too is rapidly becoming ubiquitous. For those that have the skills, determination, and need, very sophisticated services could be provided, as they are on the internet. Within the community there will always be people who will help, perhaps for free, perhaps not. Community groups themselves will probably be able to find those with the required skills from within their ranks.

The direct involvement with the community, for the community, is an excellent example of direct feedback into the community, with local stakeholders working together to enhance and enrich the local economy, community, and quality of life.

Potential Abuse

While all efforts will be put in to self-help and self-regulation, ultimately we acknowledge that there will always be abuse of the technology, whether by individuals, groups or businesses.

One potential abuse is in the form of excessive output from microwave communication devices. We see no point in excessive outputs, and will highly encourage others to follow suit, as we have had 10km to 30km links using only one-eighth the output allowed by law.

In addition, we point out that even the potential interference from an 802.11 device is dwarfed by many orders of magnitude by the power output of other ISM devices on the band, such as microwave ovens.

Whereas the internet has freed many of us from the limits of traditional sources of information, it has also been a double edged sword that, due to the anonymity and vastness of the medium, has brought unwanted influences.

Local wireless broadband is remarkably different in this respect. Where the internet is vast and anonymising, a local wireless network is smaller and more personal. The participants are far more likely to have existing relationships and this will tend to eliminate the problem of inappropriate material being half a world away and untouchable.

Whilst the potential for inappropriate material is still present, any action by the ABA to issue take-down orders will be far more effective. If a site operator does decide to move overseas, they will find it all but impossible to retain links with local wireless groups.

Examples of community benefit from community wireless groups

The specific advantages of a fully developed community wireless network are as follows:

- ✍ Community management and involvement
- ✍ Low entry and recurring costs
- ✍ Relatively high bandwidth and low latency
- ✍ Regional ubiquity
- ✍ Localised delivery of content and services

We envisage that these advantages might be leveraged into the following community benefits, amongst many others.

These examples are in no means meant to represent an exhaustive list of possible benefits. We present these only as a brief representation of the creative potential that wireless community networks might unleash. It is likely that many other heretofore unforeseen benefits will accrue along these lines which would not be readily suited to commercial operations.

Distributed Processing

Once a given system is connected to a broadband network, the capability exists to greatly extend its utility through distributed computing. Distributed processing has been in development for decades, and is now starting to enter the mainstream, through for example the various GriD initiatives. Large numbers of computers in a local network are ideal candidates for distributed processing, where each user has access to an aggregate of the total processing power available on the network, up to and including all the machines connected to the network and running appropriate software.

It is felt that the resultant geometric increase in processing power available to an end user will be so superior to single-computer processing, that the use of only the resources of a single computer will, for many applications, be considered an obsolete practice. To this end, community wireless networks can both raise public awareness of this important new technological trend, and also provide a useful testbed for the sort of experimental, grassroots development which will grow and foster a knowledge base for Australian involvement in this industry.

Narrowcasting

The ability to connect via an IP connection to any other user is just one, albeit the most obvious, use of wireless networking. Modern multicasting technologies make it simple to transmit the same content from one server to dozens, hundreds, even thousands of recipients without overtaxing the network.

In the current broadcast media model, content must appeal to a sizable fraction of the population of a region. In a multicast environment, special-interest groups could transmit content to a much smaller interest group, down to the several, or up to the several thousands.

Some special performances (such as concerts) might be popular with a large audience, but it is envisaged that most of the narrow casting on a community network will be for purpose such as school concerts, local sporting fixtures, or transmissions to or between members of the local ethnic or elderly community. This also opens up these groups to similar groups globally, reinforcing this local community while strengthening Australia's connections to the world community.

A local Landcare group could collaborate without the need to meet. Planning of activities and the broadcast of results to interested parties could be done at far lower cost. Many primary producers already use computers for farm and business planning. The availability of a localised, community managed network can strengthen regional relationships and encourage involvement in local planning issues.

Research and Development

The low cost of entry to a community network provides an ideal opportunity for students, cash-strapped educational institutions, and small IT businesses to experiment with cutting edge technologies and applications. To date, Australia has been somewhat short of easily accessible opportunities for experiment, development and training in the construction and management of broadband networks, and the cutting edge applications which they will enable. Wireless communities offer a rich environment for experiment and training, both as a network and as a technical community. We envisage a growing cross-over between the hobbyist, technical, educational and business communities, which will help to increase the skills base of Australians in this in-demand field, enrich employment opportunities, and lead to the creation of new and valuable products and services for the global market.

Accessible Services

For example, the high bandwidth of these connections makes it possible to offer services with rich-media interfaces, which provide even greater ease of use than the familiar graphical user interface (GUI). Such services could empower the differently-abled, and persons unfamiliar with, or intimidated by, current information technologies, to take a greater part in community life. In such a context, the low or zero cost of access through community networks could be crucial in making such services accessible.

Collaborative Content Creation

The bandwidth capabilities of 802.11b and similar networks, whilst not up to those of the best fixed-line networks, are sufficient to provide for some sharing of high-bandwidth content amongst creative communities. For example, teachers working on course content may be able to share video and audio files with their colleagues for editing and comment. Community radio stations in disparate parts of a city may choose to work collaboratively on programming. Independent film and video producers may be able to share content for editing. Musicians and artists in the new media field may create other, more original applications for the network involving, for example, real-time performance in disparate locations.

We envisage such an application would be taken up mostly by other, not-for-profit groups, who do not have access to the fast fixed links available to commercial content houses. Dedicated, directional wireless links between content partners may alleviate the potential for network congestion in the transmission of such high-bandwidth material.

Conclusion

1 Wireless communities are established and growing
2 Independent wireless network operators see benefits in offering public access to their networks but are concerned about their legal position.
3 Significant community benefits can be realized through the development of community based wireless networks.
4 802.11 equipment operating in ISM spectrum in metropolitan regions is not suited to "last mile" broadband use.
5 Wireless networks do not exist to compete with traditional ISP's or broadband solutions.
6 Commercial concerns should in no way take precedence over community use of an open band.
7 Wireless communities actively promote self-regulation.

Recommendations

1 Changes should be considered to the relevant acts, and/or regulations to make the not-for-profit use of wireless networks unambiguously permitted. In this case, "not for profit" should exclude more than partial cost recovery, as well as any requirement for payment or purchase of other products or services.
2 Changes should be considered to limit the liability of not-for-profit wireless LAN operators due to activities that are either undertaken without their knowledge, or are beyond their technical ability and/or resources to control.
3 Where ever possible, legislation should support the co-operation between commercial and community networks. It should not be possible for commercial interests to monopolise the ISM band; rather a harmonious working relationship should be encouraged between all users

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Appendix

- 802.11 is the common term we've applied to wireless telecommunication devices operating in ISM spectrum ranges. Originally it was the specifications given to FHSS and DSSS devices operating at 2.4Ghz with a maximum speed of 2Mbits/sec. These were made redundant by 802.11b devices.
- 802.11b is the standard applied to compliant DSSS technology in the 2.4Ghz spectrum range, that have a maximum speed of 11Mbits/sec.
- ADSL stands for Asymmetric Digital Subscriber Line. It transforms a twisted copper pair of wires between a local telephone exchange and a customer's telephone socket into a high-speed digital line. It is called "asymmetric" because it moves data more quickly from exchange to customer than from customer to exchange. This makes it particularly suitable for applications where customers expect to receive more data than they transmit, such as use of the World Wide Web, corporate intranets, and reception of digital audio-visual material.
- Broadband refers to telecommunication in which a wide band of frequencies is available to transmit information. Because a wide band of frequencies is available, information can be multiplexed and sent on many different frequencies or channels within the band concurrently, allowing more information to be transmitted in a given amount of time (much as more lanes on a highway allow more cars to travel on it at the same time).
- DSSS stands for Direct Sequence Spread Spectrum

- IAP stands for Internet Access Provider.

- IEEE stands for Institute of Electrical and Electronics Engineers Inc., their website is www.ieee.org for more information pertaining to their organisation.
- ISP stands for Internet Service Provider.
- LAN stands for Local Area Network.
- WAN stands for Wide Area Network.
- Wi-Fi is the standard commonly given to 802.11b devices that inter-operate under testing by the IEEE.
- WISP stands for Wireless Internet Service Provider. It is the comment term usually applied to commercial deployment of networks for public access in particular ISM spectrum, but could also be applied to companies that have obtained spectrum at auction.
- WLAN stands for Wireless Local Area Network.

Footnotes

✍ Some expressions of interest can be seen at the following websites (in order of totals)
- ✍ http://www.nodedb.com/nodedbs
- ✍ http://www.brismesh.org/db2
- ✍ http://www.wireless.org.au/~drew/index.ttml?pg=list
- ✍ http://www.e3.com.au/node

Virtual Colombo Plan :
http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:20020414~menuPK:34457~pagePK:34370~piPK:34424,00.html

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