Backgrounder on IEEE 802.22 Wireless Regional Area Network WG

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Motivation: Both local and long distance network providers (telcos) that build and operate the voice/data/video telecommunications infrastructure are paying increased attention to fixed broadband wireless metropolitan area networks, e.g. IEEE 802.16-2004 WiMAX, which may be ready for deployment this summer.   But WiMAX range is limited to about 10 miles, there are power and line of sight issues yet to be resolved for a broader coverage area. WiMAX deployment is therefore limited to densely populated metropolitan areas. What about rural or sparsely populated, geographically dispersed regional areas?

One of the most promising new approaches for broadband wireless **regional area networks** (with a greater coverage area then metro networks) is the new **IEEE 802.22 Working Group (WG) on Wireless Regional Area Networks (WRANs).** Telcos in the U.S. that serve rural areas and network operators in countries with sparsely populated or geographically dispersed users (e.g. Australia, Canada, South America, etc) will seriously consider **early deployment of 802.22 - based WRANs**. Fixed line long distance telcos will consider using WRANs to broaden their networks reach by creating broadband wireless tail circuits to business customers. Hence, the work that is being done in the 802.22 WG will have a huge potential market.

The 802.22 WG is chartered to develop an **interoperable air interface** for use in spectrum allocated to **TV Broadcast Service**, thus enabling a Point to Multipoint (P-MP) Wireless Regional Area Network (WRAN). The WRAN system will provide packet-based transport capabilities that can support a wide range of services (e.g. internet access, data transport, voice and streaming video) to residential, Small and Medium Enterprises (SME) and Small Office/Home Office (SOHO) locations.

The WGs home page is at:

http://www.ieee802.org/22/

Meetings: The IEEE 802.22 WG held its first meeting at the November 2004 IEEE 802 plenary in San Antonio, TX, where the PAR was reviewed, IEEE Patent Policies were explained, WG Policies and Procedures were approved, the WG elected officers, and a decision was made to hold the WG interims in conjunction with the joint wireless interim meetings of 802.11, 802.15, 802.18, 802.19, 802.20, and 802.21 (and 802.16 when they choose to join the other wireless WGs). So attending 802.22 interim meetings offers the opportunity to attend and meet with participants of the other wireless area network WGs.

There was an interim meeting session in Monterey, CA, in January 2005 and the 2nd plenary meeting in Atlanta, GA, in March 2005, which I attended and reported. There

were many network operators present, including NTT, Korea Telecom, Qwest, AT&T. There were also broadcasters present from CBS and NAB among others.

At the March meeting, the 802.22 committee desired to reach an understanding and consensus for functional requirements before proceeding with developing standards for 802.22 MAC and PHY protocols and thus spent the entire March meeting working on a **Functional Requirements** document.

The interim meeting in May 2005 will be held in Cairns Convention Center, Australia. The early registration deadline in April 4th and the link is:

https://secure.tourhosts.com/ei/hotels/GeneralInformation.pdf

Markets:

WRAN technology is initially targeted at wireless broadband (remote) access for geographically dispersed, **sparsely populated** areas. The transmission range can be up to 100Km, Non Line of Sight (NLOS) due to use of TV broadcast bands as License Exempt (LE) spectrum. Hence, this new network technology should be of interest for remote access to grid computer sites and to independent telcos operating in developing countries, rural or non- metropolitan areas.

The target markets for 802.22 WRANs are not an exhaustive set, but serve as guidelines and examples that suffice for meeting the broad applicability goals set forth by the air interface "Five Criteria" as described in the IEEE 802.22 Project Authorization Request (PAR) and "Five Criteria." The PAR can be downloaded (free) from:

http://www.ieee802.org/22/802-22_PAR.pdf

The **target markets** to be addressed by the 802.22 protocols in WRAN networks are single family residential, multi-dwelling units, SOHO, small businesses, multi-tenant buildings and public and private campuses. In accordance with ITU-R definitions, Fixed Wireless Access (FWA) (and hence WRAN) provides access to one or more (public and private) core networks, rather than forming an end-to-end communication system. 802.22 systems serve fixed location customers, but who might be geographically fixed, re-locatable or nomadic.

A Wireless Regional Area Network (WRAN) system based on 802.22 protocols is intended to make use, on a non-interfering basis, of **unused TV broadcast channels** (6MHz, 7MHz, or 8MHz) to address, as a primary objective, rural and remote areas and low population density underserved markets with performance levels similar to those of broadband access technologies such as digital subscriber line (xDSL) technologies and Digital Cable modem service. A secondary objective is to have this system scale to serve denser population areas where spectrum is available.

The WRAN system must be capable of supporting a mix of data, voice and audio/video applications. These include Internet access, VoIP, video teleconferencing and streaming video.

WRAN System Overview: [please refer to March 05 meeting report for more details]. The **critical** parameters for serving these markets using **wireless access technology** is the combination of coverage / capacity factors that affects access cost per user, the ease of deployment, maintainability and product costs associated with the customer premise installation, and the spectrum efficiency / reuse for economically serving the required number of customer locations with a minimum number of base station locations and backhaul routes.

The 802.22 wireless regional area network system is aimed at providing broadband access with capabilities similar to the ADSL and cable modem technologies over less populated rural areas. The **typical range** of the system is 33 km (based on F(90, 99.9)) for a coverage of population density of 1.25 person/km2 and above, maximum is 100km. The system will need to operate over a set of typical channels models. Provisioning (as usual) was not discussed at this meeting. It will likely be a proprietary feature for the network operators.

Innovation Applies Here: The WRAN network will require use of **cognitive radios** in Base Stations. These will sense usage of frequency bands, negotiate with and signal to other Base Stations for sharing or re-allocation of common spectrum.

IP QOS strategies (TBD) will be employed to permit various services to be combined. These may include fast Internet access (competing with DSL and Cable rates), VoIP, video teleconferencing, and streaming video. Other services may be possible. The classes of service are similar to what was defined for ATM:
- **Constant bit rate service**
- **Real-time variable bit rate service**
- **Non-real-time variable bit rate service**
- **Best-effort service**

In addition there will be **policy based SLAs** which include the following

- Restricting Access to the air link

- Rules for discarding data (TBD)

- Dynamically controlling bandwidth to a user or group of users (based on channel change policies)

- Performance Monitoring service (PM parameters TBD)

- Levels of 802.22 WRAN services that are provided at the delivery point

Request for Sponsorship for IEEE 802.22 meetings:

In order to continue to participate in the IEEE 802.22 WRAN WG activities, I will need a sponsor company to pay for my expenses and time attending the meetings and writing the reports. If your company is interested in investigating this promising new technology – as a network operator for potential deployment or for equipment/component development and sales to telcos and broadcasters – I would strongly encourage you to sponsor my attendance and participation in the 802.22 WG. Thank you for your consideration.