Saankhya Labs

White Spaces: Present and Future

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Q: What is the significance of TVWS broadband connectivity in the age of 2G/3G/4G/ VDSL/ADSL broadband? Why is it a necessary?
A: Spectrum is a scarce resource and each MHz of Spectrum is costing millions of dollars to the telcos. For instance 20 MHz of 4G spectrum in New York metro was auctioned for $2.8bn. Due to high capex and opex cost, telcos optimize their services based on Average Revenue per User (ARPU) in a given region, leaving rural and sparsely populated areas under served.

According to one estimate, over 3 Billion people mostly in rural areas are deprived of connectivity for a number of reasons.

The low cost connectivity enabled by the license exempt TV White Space (TVWS) spectrum helps to bridge this digital divide and make a profound impact on humanity.

Q: What are the main requirements of wireless ISPs (Internet Service Providers) in rural areas?
A: 1. Presence of a cost effective backhaul.
2. Easily Scalable (increase revenues).
3. Deployment of Triple Play (Data, Video and Voice) (and increase revenues).
4. Robust and Reliable network (low support costs).
5. Low Capex and Opex; minimal and remote maintenance (e.g. solar powered base stations).
6. Fast installation.
7. Low/Zero down time.

Q: Could you talk to us about how you view White Space and its ability to help with cost effective service deployment?
A: Features of White Space and their benefits to Wireless ISPs (Internet Service Providers):
1. Works in the license exempt spectrum and hence enables a low capex and low recurring cost connectivity solution. The TV white space being in the VHF/UHF frequency range (has longer range, better penetration through both foliage and severe weather conditions; has Lower capex due to base station covering a larger area.
2. Works Non line of Sight (simple installation and low maintenance).
3. Cognitive Radio – does not need dedicated spectrum. Devices wake up and converse in a channel that is available in the allocated band.
4. Very Cost effective – low cost base station and CPEs for sparsely populated areas of the country (rural areas). Cost of building a TV whitespace network to provide 2Mbps speed to about 800 subscribers in an area of 200 sq km is about a third of the cost of building an LTE network!
5. Low Power: Whitespace network equipment (base station and customer premises equipment) consume less power and hence can be powered off solar panels.
6. TV White Space is a Scalable Network (build as you go network) unlike most of the other network technologies which are based on the premises that "build and they will come".
7. Co-exists with the incumbent Analog/Digital TV transmissions and does not suffer from severe interference prevalent in ISM band frequencies.
8. Co-exists with other networks. Unlike WI-fi's "listen before talk" which is polite but leads to inefficient use of spectrum and LTE's "my way or highway", TVWS takes the middle approach. Co-existence is built into the standards and is co-ordinated by a database.
9. Quick time to commission a network in emergency situations.

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► Q: Saankhya Labs was the first company to launch TV White Space baseband radio module, could you talk us through the problems you overcame and the achievement of this?

A: Saankhya developed a unique Software Architecture that enabled seamless implementation of MAC and IEEE 802.22 PHY based on its fully programmable SDR chipsets, without compromising on the functionality, scalability and maintainability of the software. SDR architecture also gives us the advantage to fine tune the performance of our products after they are deployed in the field.

We developed the full telecom protocol stack as per WiFAR/802.22 for both the Base station and CPE side software. This is like Ericsson and Qualcomm's complexity rolled into one. To manage this massive effort, we introduced new methodologies and higher abstractions to quickly implement this code. This will enable Network Equipment OEMs to deploy product quickly with their operator customers.

Being the first company to develop product compliant to a standard (WiFAR and IEEE 802.22) there was a lack of test equipment or 3rd party equipment to test interoperability. Saankhya has developed complete test bed for 802.22 network equipment before they are deployed in the field.

Saankhya has done rigorous testing of the RF module to meet the tough FCC requirements for TVWS equipment.

Figure 1: Saankhya Labs TV WS Base Station

Figure 2: Saankhya Labs outdoor CPE

Q: Where do you see the highest use of white space and can you envisage a big up take in the near future?

A: TVWS solution has multiple use cases, key ones are listed below:
a.   Rural Broadband connectivity and Triple Play Services.
b.   Railway Broadband.
c.   Machine to Machine communication.
d.   Internet of Things.
e.   UAV/Drone Wireless Video communication.
f.   Smart City infrastructure.

Each of the application areas has different challenges in terms of requirements, cost, form factor, RF power, deployment scenarios, interference challenges and legal framework.

While the latent potential quotient is highest for M2M and IoT in the mid to long term, rural broadband connectivity will be the biggest driver for Saankhya in the short term. This is primarily because of:

a)   The vast opportunity that exists in India, Africa, Middle East & ASEAN countries for rural internet connectivity;
b)   Current cost structure of the module.

TV White Space Opportunity in India

While the US, UK and Singapore have regulated white spaces deployment the big uptake is going to come from India and South-East Asia, Africa and South America. The government of India has embarked on an ambitious "Digital India" program to provide internet access to all villages. TVWS is being considered as one of the last mile access technologies. We are working together with Microsoft and others to frame a policy for the same. The country's internet backbone (fiber) is being deployed up to the 250K Gram Panchayat offices (Gram Panchayat is a group of villages which administers and takes care of the welfare of the people in these villages). The villages can be as far away as 8 – 15 kilometers from the Gram Panchayat office. We cannot expect the households in these villages to come to the Gram Panchayat daily to access internet for a few hours. It is important to take the network connection point closer to the villagers. The households in these villages lack wired infrastructure. So, long range wireless networks are preferred to bring the network connection to the households in the villages.

In the US and Europe we envisage 'TVWS hotspots' that can provide offload to carriers and OTT services like Whatsapp calls. In addition they will function as IoT hotspots and provide either long range communication or as a backhaul for front-haul technologies like Zigebee, BLE and 6LOSPAN, among others.

In the developing countries the uptake is clearly from internet for people, while in developed countries it is from the Internet of things!   ►

Railway broadband application
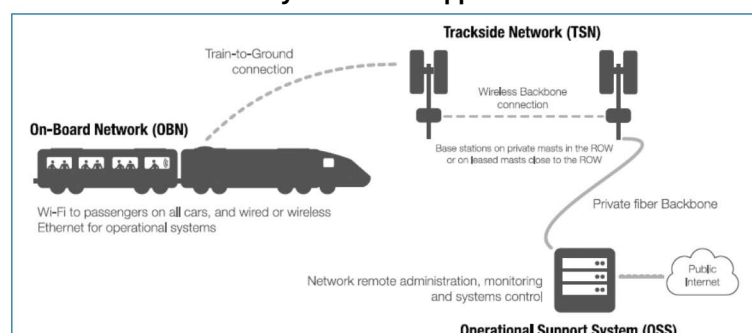
► **Q: What are the main problems you are facing in getting across the message of the technology and your company's success in deployment?**

A: 1. Delay in legitimizing the usage of TVWS and announcing a legal frame work is the biggest concern today. Governments, especially in developed economies, are moving ahead with caution. The broadcast and telecom lobbies are strong and have their influence on the decision making process.

2. Cost: The cost of the base station and CPEs will go down when the policies are in place and the volume starts to build. Saankhya is working on next generation highly integrated products to drive cost down further.

3. Awareness: Lack of awareness of TV Whitespace networks & its capabilities among Wireless ISPs.

Q: Is there any current news from Saankhya, that we need to know about and are there any papers our readers should look at for further information?

A: Please visit www.saankhyalabs.com

Q: What is the future of WS in general?

A: TVWS networks are an important departure away from statically allocated spectrum to more flexible and efficient Dynamic networks. Future networks have to be very frequency and bandwidth agile. Spectrum harvesting is required to get the most of the scarce resource. An important step towards that is making networks cognitive and dynamic. There is some cognition built in TVWS networks, in the form of spectrum sensing and co-existence. Also, they have to operate in interference heavy environments which mandates agility, even from a modulation perspective.

Saankhya is building technology and solutions that marry Big data and machine learning to access networks that we have coined as Dynamic RAN. This will enable operators to get most out of spectrum and also help manage them more efficiently.
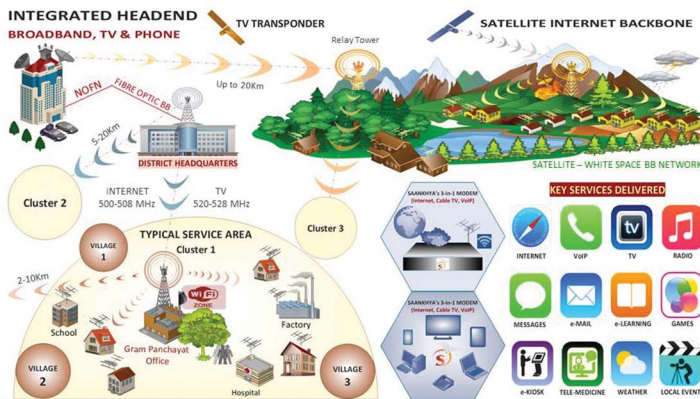
Q: How can Saankhya's white space network be extended by the operator for deploying triple play services?

A: Saankhya's software defined radio technology can be configured to work in the CPE (customer premises equipment) either as a modem (receiving data, skype calls) or as a set top box STB (to receive DVB T broadcast signals). With this rural households can receive broadcast TV programs in addition to internet and VoIP calls using one piece of network equipment.
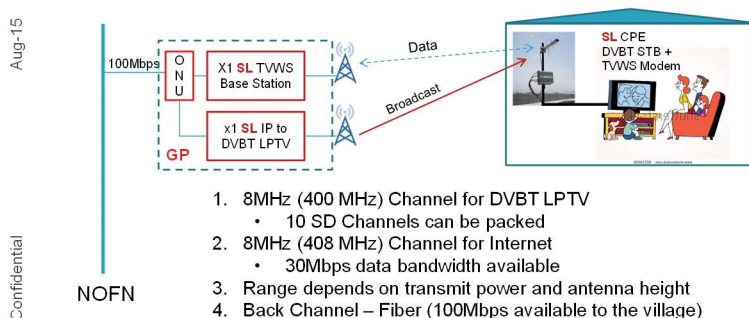
In India, the backhaul for connecting the Whitespace network to the backbone will be provided via the Nation's Optical Fiber Network (NOFN).

For more information visit:
www.saankhyalabs.com

Last Mile Triple Play Connectivity with NoFN

1. 8MHz (400 MHz) Channel for DVBT LPTV
   - 10 SD Channels can be packed
2. 8MHz (408 MHz) Channel for Internet
   - 30Mbps data bandwidth available
3. Range depends on transmit power and antenna height
4. Back Channel – Fiber (100Mbps available to the village)

About Saankhya Labs:
Saankhya Labs, founded in 2007, is a fabless semiconductor company specializing in the development of Cognitive Software Defined Radio (SDR) communications processors and modules supporting a broad range of emerging data communication standards. Powered by its award-winning Software Defined Radio (SDR) architecture, Saankhya chipsets combine low power, cost efficiency and small footprint, making them ideally suited to build ONE Worldwide platform for applications such as TV White Space (TVWS), Machine to Machine (M2M) communication, 2-Way Satellite Communication and Internet of Things (IoT) devices. Saankhya was featured in the 2014 Global edition of Electronic Engineering Times "Silicon 60: Hot Startups to Watch" list.