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IEEE

Broadcast Technology Society Newsletter

The technologies to deliver information and entertainment to audiences worldwide, at home and on the go.

From the President

Dear BTS Members:

As I wrap up my fifth and final year as BTS President, this edition of "From the President" will be my last opportunity to communicate with you in this Newsletter space. So, this expanded column will be a "State of the Society" report, reflecting on our progress and on some of the opportunities and challenges still ahead. I'll focus first on three areas – Membership, Conferences, and Publications – which also represent our three income streams. Then, I'll discuss our Project Initiatives – both continuing and new – and wind up with some financial and operational issues.

Membership. I've reported the good news and the not-so-good news about membership in several previous Newsletters. After declining steadily from its peak in 1995, BTS membership held its own in 2005, actually eking out a small gain of 0.2 percent. Each month this year, we've seen an increase over the same month last year – except for February, when the Terminator dropped 542, or 29 percent, of our 2005 members who had not renewed. This was the average percentage loss for all Societies, and one percent less than the loss for IEEE overall. August is the close of the dues year, and the benchmark for determining retention. (Beginning in September, new memberships are valid through the end of the upcoming year.) As of this August, BTS was up by 3.5 percent over a year ago, one of only 16 societies (out of 39) to show an increase. This is even more impressive considering the average 3.3-percent decline in Society memberships overall, and only a 0.9-percent increase in total IEEE member-

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From the Editor

As the season changes from fall to winter here on the east coast of the United States changes are also happening within the BTS. As of January we will have a new president and vice-president. Bill Hayes of Iowa Public Television will succeed Tom Gurley as president and your Newsletter Editor will become the new vice president replacing Charlie Einolf. (See inside for an article on the new officers).

Tom's term will expire at the end of 2006 and he is not eligible to continue. Likewise, Charlie's term also will come to an end. Although we would have been happy to have Charlie step into the presidency he also is not eligible since he is now president of the Industrial Electronics Society and cannot serve in the same capacity for two societies. Charlie has also served as the chair of our publications committee that is traditionally one of the duties of the vice-president. I am happy to report that Charlie has agreed (subject to the expected approval of the new president) to continue as chairman of the

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Inside

IEEE

From the Editor continued

publications committee as I will wear two hats as both vice-president and editor of the Newsletter at least for the immediate future.

I would like to take this opportunity to thank Tom for all his hard work in trying to improve our society. During Tom's tenure, we began a strategic planning effort and have made significant progress in identifying a number of areas where the Society can be improved to offer more value to our membership. Under Tom's leadership, membership has begun to increase after a significant decline. Tom was also largely responsible for launching last April a new and successful International Symposium on Broadband Multimedia Systems and Broadcasting. These are just a few of the accomplishments that have taken place on Tom's watch. Thanks Tom for all the hard work and we hope that you will continue to be involved as we can all benefit from your knowledge and insight as we try to move the Society forward.

Thanks also go out to Charlie who has always been there to try and keep us on course. Charlie has also chaired the publications committee during a period that has seen our Transactions publication not only grow in size and quality but more importantly for our society it has vastly improved its standing among the other publications related to communications. Many thanks to Charlie and we look forward to your continued involvement.

I would also like to congratulate Bill Hayes on his being elected society president and I am excited and looking forward to working with Bill in both may capacity as Newsletter editor and as the society vice-president.

Congratulations are also in order for Guy Bouchard and the members of his committee on another very successful fall Symposium. From my observation we had a great turnout and as usual very worthwhile sessions. It was also good to see old friends and have the opportunity to make some new ones. If you have never attended the BTS Fall Symposium please start making plans to attend next year you'll be glad you did. Details will appear on the BTS Web Site as soon as the plans are finalized.

We have also heard that the IBC was once again very successful. This is great news for the BTS since as one of the partners in the IBC we reap a substantial financial benefit as well as helping promote our society outside the United States.

As reported in this column on several occasions I continue to be committed to adding more meaningful content to the Newsletter. To that end this issue contains an article from Jerry Whitaker about ATSC Work Progresses on the DRL Standard, a broadcast history article from James O'Neal and the first in a series of articles on the progress of transition to digital television in the United States. These are in addition to our usual news reports from our chapters and reports on the recent Symposium and the very successful IBC.

As always I encourage you to share your own knowledge and contribute and there may be some added incentive in the near future – stay tuned for more details.

Bill Meintel
wmeintel@computer.org

Newsletter Deadlines

The BTS Newsletter welcomes contributions from every member. Please forward materials you would like included to the editor at wmeintel@computer.org. Here are our deadlines for upcoming issues:

Issue	Due Date
Spring, 2007	January 20, 2007
Summer, 2007	April 20, 2007
Fall, 2007	July 20, 2007
Winter, 2007	October 20, 2007

From the President continued

ship. So, we're doing well in attracting new members to BTS. But, both BTS and IEEE need to improve retention rates. This represents a challenge to identify members' needs better, and to continue developing new products and services that will provide increased value for your ongoing membership.

Conferences. One of our new project initiatives budgeted for this year called for establishing a conference in the emerging technology area of Mobile/Multimedia Broadcasting. BTS successfully launched the new conference in April – the IEEE International Symposium on Broadband Multimedia Systems and Broadcasting, or Broadband Multimedia 2006. Although we had been prepared for a loss on this inaugural conference, it proved to be successful both financially and technically. Some one hundred attendees were on hand in Las Vegas for the two-day conference, featuring sixty technical presentations and keynotes from industry leaders, and representing seventeen countries.

The Broadband Multimedia Symposium was co-located with CTIA WIRELESS 2006, adding this annual wireless industry trade show to the roster of major conventions at which BTS has a

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significant presence. Most of the attendees were neither members of BTS nor traditional broadcasters, presenting an opportunity for BTS to reach a previously untapped, more diverse, and younger demographic.

In 2007, our Broadband Multimedia Symposium will be one of three IEEE conferences under the umbrella of "IEEE @ CTIA WIRELESS 2007." BTS is also a co-sponsor of one of the other conferences – the IEEE International Conference on Portable Information Devices, or Portable 2007. The IEEE Communications Society is facilitating the umbrella event, through its established relationship with CTIA. Given the rapid convergence of multimedia broadcasting, telecommunications, consumer electronics, and networking technologies, such intersociety, interdisciplinary collaboration is increasingly important.

BTS continued its longstanding partnership with the NAB Broadcast Engineering Conference in April, presenting a technology tutorial on "Delivering Television to Handheld Devices" to a standing-room-only audience. We look forward each year to bringing our tutorial content and our membership message to NAB attendees.

Our financial partnership in the International Broadcasting Convention (IBC) provides the largest source of income for BTS, and it also provides another major forum for sharing our tutorial content and disseminating our membership message. Our contribution to the Conference Program raises the profile of IEEE-BTS as a partner of IBC, and it contributes to the IBC mission of "by the Industry, for the Industry." This year's Tutorial on Video Display Technology, presented on September 7, drew a capacity audience of some one hundred attendees.

The IEEE Annual Broadcast Symposium, a tradition for 56 years, continues to be our flagship event, even as it diversifies and evolves with the changes in our industry. As I told our audience in September, the Broadcast Symposium "is as old as radio, yet as up-to-date as mobile TV and IPTV." This year's Symposium drew 167 people from 11 countries, a 24-percent increase in attendance over last year.

Publications. The Transactions on Broadcasting has reached a new milestone in prestige. Based on the rankings of the 2005 Journal Citation Reports (JCR), published by Thomson Scientific, our Transactions moved into the top 25% of journals in the Telecommunications field, ranking 14 out of 59. In 2004 and 2003, the Transactions ranked 20th and 33rd in the field, respectively. Out of 208 Electrical and Electronics Engineering journals, worldwide, the Transactions ranked 61 in 2005, up from 92 in 2004 and 139 in 2003. The JCR ranks journals by their impact factor – a measure of a journal's influence in the global research community, based on the number of times its articles have been cited.

A number of BTS members contributed to the January 2006 Proceedings of the IEEE Special Issue on Global Digital Television. The introductory Overview, by four of our members who served as Guest Editors, was one of the most downloaded papers from IEEE Xplore in January. All BTS members received a complimentary copy bundled with their March issue of the Transactions.

In 2007, the Transactions will publish a Special Issue on Mobile Multimedia Broadcasting. With more than 300 pages of high-quality papers, this will be a separately bound publication bundled with the regular March issue of the Transactions.

Our Newsletter also continues to improve, in both the quantity and quality of its content. Its look was colorfully updated last year, and each of the past four quarterly issues has had twenty or more pages of reports on BTS activities, industry news, interesting feature articles, and brief technical papers. We continue to seek timely, practical, and applications-oriented content for the Newsletter, to complement the research-and-development emphasis of the Transactions.

Initiatives. In the Fall 2005 Newsletter, we described three new BTS project initiatives planned for this year: Mobile & Multimedia Broadcasting Technology; Conference/Publication on Mobile/Multimedia Broadcasting; and Broadcaster Education. Under the first project, we worked with the IEEE Membership Development Committee to conduct Focus Groups at CTIA WIRELESS 2006, the venue for our new Broadband Multimedia Symposium. Analysis of the consultant's report on these Focus Groups and those conducted at IBC and NAB last year, and identification and development of appropriate products and services to address this new technology segment, are ongoing into 2007. Under the second project, we launched our new Symposium in April and prepared for the publication of our Transactions Special Issue in the first quarter of 2007. Progress on the third project has lagged this year, primarily due to the unavailability of volunteer resources, but funding for the Broadcaster Education Initiative will be continued into 2007. Work is already underway on scholarship programs that will be announced next year, and tutorial content from this year's two Symposiums has been recorded for re-purposing via the Web – either an enhanced BTS website or the new IEEE.tv.

Enhancement of the BTS website, to provide a "spiffier" multimedia web presence and links to IEEE.tv content, is one new initiative for next year. We've learned from our Focus Groups that members want more immediate access to information and better opportunities for networking with others in the industry. The ubiquity of the Web can support these needs, if we can figure out how to use it more effectively.

We've also budgeted a Membership Initiative for 2007. This will address the challenge I described above, under Membership – how to improve retention, as well as attract new members, by improving the value proposition. We also want to bring BTS closer to its members by enhancing and expanding our local chapter activities worldwide. This is another need expressed by our Focus Groups. We are already identifying potential locations for new local chapters, and we urge you to help us in this effort. This is one activity that cannot succeed without local volunteer participation.

Our Standards budget has been increased for 2007, to permit participation in the ITU-T work on IPTV standardization, continuation of our liaison

with the IEEE 802.22 work on unlicensed Wireless Regional Area Networks that will operate in the broadcast TV bands, and our traditional work on broadcast RF and Audio/Video standards and our participation in the ATSC. Our Focus Groups have emphasized the importance of our helping members to understand and use standards. So, our direct participation in the development of those standards for our industry is vital.

Finance & Operational Issues. Our Society is financially sound, with growing income and reserves, thanks largely to our partnership in the IBC, which continues to grow each year. BTS has become a million-dollar business, serving some 2,000 clients worldwide. But, it operates within the framework and with access to the resources of the IEEE, the world's largest technical professional association, which has more than 350,000 members, and is a $300M global business.

BTS, like all of the IEEE, is a volunteer-driven organization, and our loyal and growing cadre of volunteers remains our bedrock. But, the execution of many of our activities lags due to the significant amount of effort and time required, which is getting to be increasingly difficult for volunteers to accommodate in their busy schedules. This resource shortfall may be attributed to our relatively small pool of members, compared to other Societies, and the relatively large proportion of members from industry, whose day job has priority over volunteer time. But, this limits our ability to meet our members' and potential members' needs and to fulfill their expectations upon renewing or joining BTS. As an example, implementation of the plans developed over the past couple of years by our Strategic Planning Committee has, itself, lagged due to the lack of volunteer time to address it. Going forward, it will be imperative for BTS to operate more like a business and increasingly look to paid personnel to provide management, administrative, editorial, and project support, as more and more Societies are already doing. Fortunately, unlike some other small Societies, BTS has the requisite financial resources.

In closing, I want to thank all of you for your membership and support of BTS over these past five years. It has been a pleasure and an honor for me to serve as your President. The revitalization of BTS is a work in progress, begun by my predecessor, Gary Cavell, who established a solid foundation upon which we could build. It will continue under the leadership of Bill Hayes, to whom this space will belong in the next Newsletter.

With best regards,

Tom Gurley
President
IEEE Broadcast Technology Society
tgurley@ieee.org

The BTS AdCom Elects BTS President and Vice President

EFFECTIVE 1 JANUARY 2007

On 26 September 2006, the BTS AdCom voted in a new President and Vice President to succeed President Tom Gurley and Vice President Charles Einolf, Jr. effective on 1 January 2007. Our Society expresses its deep thanks and appreciation to President Gurley and Vice President Einolf for providing outstanding dedication, leadership and guidance for advancing the mission and goals of the IEEE Broadcast Technology Society during the past five years.

William T. Hayes
IEEE BTS President 2007
Director of Engineering and Technology
Iowa Public Television

Bill Hayes received a Bachelors Degree in Communications in 1977 and has worked in broadcasting since 1973 in both radio and television. He has planned and constructed two start-up full power television stations. In addition Bill has extensive experience in planning, design and the construction of all facets of a television station. He is currently responsible for the planning and development of all technology projects at Iowa Public Television (IPTV) including RF transmission facilities, studio origination facilities and 750 interactive classroom facilities throughout the State of Iowa. In addition to his position at IPTV, Bill is also an author for TV Technology, a leading technical magazine. He is a member of the IEEE BTS, SMPTE and SBE and is involved with the educational and standards committees for these organizations.

William Meintel
IEEE BTS Vice President 2007
Meintel, Sgrignoli and Wallace Consultants

Bill Meintel holds an Electrical Engineering degree and has 37 years experience in the communications field. After graduation, Bill was employed by the FCC, first as a field engineer and then in the Media Bureau's Policy and Rules Division. There, Bill directed the development of several major computer modeling projects related to spectrum utilization and planning related to broadcasting. He entered private practice in 1989, and has been heavily involved in technical consulting, computer modeling and spectrum planning for the broadcast industry. During that period he co-authored a report for the NAB on spectrum requirements for DAB, created a plan for independent television broadcasting for Romania and has been extensively involved in spectrum planning for digital television in both the US and internationally. Currently Bill is a partner in the consulting firm of Meintel, Sgrignoli and Wallace.

Bill has been a member of the Broadcast Technology Society for the past 17 years, is in his second term as an at large member of the AdCom and has been editor of its BTS Newsletter since 2003. He is also a member of the Engineering Honor Society Tau Beta Pi.

BTS Information Booth and Tutorial at IBC 2006 Attracted Many Visitors and Created Much Interest

The IEEE BTS team of President Tom Gurley, IBC Board Representative Mike Bennett, IEEE Transactions on Broadcasting Editor-in-Chief Yiyan Wu, and Administrator Kathy Colabaugh, planned, organized and staffed the BTS Information Booth at IBC 2006. The Broadcast Technology Society participates on the IBC Partnership Board which represents the owners of IBC. The IBC conference and exhibition was a great success this year, with over 45,000 people attending from over 130 countries and over 1200 companies showcasing business ideas in broadcasting and media. The IEEE BTS Information Booth was active during the entire event, signing up 18 new BTS members, and answering an array of questions about IEEE and BTS services, benefits and publications. In addition, the IEEE BTS team met several people who expressed an interest in authoring papers for the IEEE Transactions on Broadcasting and the BTS Newsletter.

On Thursday, 7 September, BTS presented a Tutorial on Video Display Technology. BTS is a co-sponsor of the IEEE/OSA Journal of Display Technology, which was launched last year. AdCom members Richard Friedel of Fox and David Bancroft of Thomson UK were instrumental in crafting this tutorial and rounding up the guest speakers. The tutorial included leading researchers and developers worldwide to explain recent developments in the context of both consumer and professional applications. It also offered a peek at emerging technology still in the laboratory. David Bancroft did an outstanding job as Chair and Moderator of the Video Display Technology Panel. Speakers included Hans Hoffman - European Broadcasting Union, Switzerland, John Zubrzycki - BBC Research, UK, Charles Poynton - Consultant, Canada, Paul Boynton - National Institute of Standards and Technology, USA and Hugo Gaggioni - Sony Electronics USA. Over 100 people attended the tutorial, filling the meeting room to capacity. The IEEE BTS extends it heartiest thanks and appreciation to David and Richard for their efforts in this successful event.

Below are photographs from the BTS sponsored Video Display Technology tutorial.

The IEEE BTS representation at the annual IBC conference and exhibition proves to be a continuing success every year. Next year, the IBC event will be held in Amsterdam, The Netherlands, with the technical conference from 6-10 September 2007 and exhibition from 7-11 September 2007.

Dave Bancroft, John Zubrzycki, Charles Poynton and Paul Boynton follow a presentation on the monitors.

Hans Hoffman presents his topic "IEEE Seminar on Video Displays: State of the art and user requirements"

The IEEE BTS presence in the IBC Partnership Village

Hallway banners promote the partners of IBC

56th Annual Broadcast Symposium a Great Success!

Some 31 presentations and over 160 Attendees at the September event in Washington, DC, USA

David E. Young, VP Verizon, keynote speaker at the joint BTS/AFCCE luncheon. "Fiber to the Premises: Lighting the Way to Cable Competition"

John Abel, US Telecom Assoc, Keynote speaker at the BTS Awards luncheon "Where are the Digital Networks Taking Us?"

John Day, IEEE, provides a luncheon talk on "Introduction to IEEE.tv"

Camera crew taping Symposium sessions for IEEE.tv

Matti S. Siukola Memorial Award. Sid Shumate with winner Andy Bater - In recognition of the best paper presented at the IEEE 55th Annual Broadcast Symposium entitled "A Flat Earth DTx Implementation."

Scott Helt Memorial Award for the best paper in the Transactions on Broadcasting for 2005. Yiyan Wu with winner Matthew Rabinowitz – for the paper co-authored with James J. Spilker, Jr. entitled "A New Positioning System Using Television Synchronization Signals"

Past President Jerry Berman (1993-1994) and President-Elect Bill Hayes (2007-2008)

Symposium Chair Guy Bouchard, attendee Mark Fehlig of Georgia Public Broadcasting, BTS President Tom Gurley, and Dennis Wallace of Meintel, Sgrignoli and Wallace.

Speaker Young-Woo Suh from Korea, Assistant Technical Program Manager James Fang, speaker Rodrigo Admir Vaz from Brazil

Presenters of the on-channel repeater papers for 3 major broadcasting standards (L to R) Jonathan Loo (Brunel University, UK, DVB-T standard), Koichira Imamura (NHK, Japan, ISDB-T standard) and Young-Woo Suh (KBS, Korea, ATSC standard), and Yiyan Wu (CRC, Canada)

Your BTS Team working at the Symposium. (L to R) Jessica Lotito, IEEE Conference Planner, Kathy Colabaugh, BT Society Administrator, and Lynda Bernstein, BTS Publications Coordinator

Attendees at the joint BTS/AFCCE Luncheon

BTS President Tom Gurley addresses the Luncheon group

Speaker Jian Song, giving the first presentation, outside of China, of their newly adopted DTV standard

Symposium speaker Jonathan Loo, UK, enjoys the BTS Newsletter

Advanced VSB System display at the Symposium with speaker Jungpil Yu, Samsung

Panel Discussion on Unlicensed Devices in the TV Bands. Panelists (L to R), Carl Stevenson – WK3C Wireless LLC, Victor Tawil – Assoc for Maximum Service Television, Alan Waltho – Intel Corporation, Khalil Salehian – Communications Research Ctr, Canada

IEEE.tv Demonstrated at the IEEE BTS Broadcast Symposium

On 28 September 2006, a special luncheon presentation was provided to the IEEE Broadcast Symposium attendees. John Day, Senior Manager of Business Development for IEEE Regional Activities, provided a highly informative briefing followed by a video presentation which demonstrated the new IEEE Internet broadcasting service called IEEE.tv. Below is an overview of IEEE.tv as published in the 5 October 2006 issue of the IEEE Institute. BTS members are encouraged to visit the IEEE.tv site and make use of this new service.

IEEE.tv: New Broadcaster Hits Town

by John Day

After more than 100 years of publishing magazines, the IEEE might think broadcasting is outside its scope. Studios, lights, cameras, microphones—the complexity of it all seemed too daunting to consider seriously. But IEEE felt it had a role to play and released its Internet broadcasting network in August.

"IEEE.tv is intended to make broadcasting a vibrant and valuable component of the IEEE member's experience," says Pedro Ray, vice president of IEEE Regional Activities, the area that oversees the station. "And it will advance the IEEE's commitment to educating the public on important technology and engineering issues."

IEEE.tv features original content, with broadcasts that include coverage of IEEE conferences, interviews with IEEE book authors, primers on technology-related careers, and overviews of IEEE products and services. The prerecorded programs run anywhere from 5 to 45 minutes; it is expected that most programs will be 15 minutes or less.

TWO TRACKS

IEEE.tv comes in two formats: the Member/Basic format, available only to members, can be accessed through the myIEEE members-only portal (www.ieee.org/myieee), while the freely available Public Access format (www.ieee.org/ieeetv) offers information about careers in technology and engineering and offers demonstrations of new technology used in everyday applications. The presence of a padlock-shaped icon in the margin of a program indicates that it's only for member access.

Programs are divided into five areas that reflect the different aspects of the IEEE experience, according to David Green, chair of the IEEE.tv Advisory Group.

- **Conference Highlights** provides an overview of selected IEEE conferences and includes interviews with key presenters. Conference-related programming will appear monthly. Upcoming programs focus on ethics in engineering, and using analog circuitry in a digital era.
- **Meet the Authors** presents interviews with IEEE authors who have written books in a variety of technical and engineering fields. For example, currently Richard Schreier talks about his book "Understanding Delta Sigma Converters" (Wiley–IEEE Press, 2004). Later this year, Mostafa Sherif will share insights from his book "Managing Projects in Telecom Services" (Wiley–IEEE Press, 2006).
- **Careers in Technology** explores technology careers and developments in new technical disciplines; it also profiles various interesting jobs.
- **IEEE.tv Specials** profiles significant people in technology and engineering and chronicles past historical developments. Now playing is a question-and-answer session with the two 2007 President-Elect candidates, Lewis Terman and John Vig.
- **IEEE Products** gives brief introductions to IEEE initiatives and products, such Expert Now IEEE, which are 1- to 2-hour online training courses based on tutorials presented at IEEE conferences.

As of mid-September, about 10 programs were available for viewing on IEEE.tv, and new programs are continually being added.

For more information, visit www.ieee.org/ieeetv.

United States Moving Closer to All Digital Television System

By Bill Meintel

This is to the first in a series of articles documenting the transition to an all digital television system in the United States.

After almost 20 years, the United States is in the final countdown to an all digital television system. The move to digital began with a petition to the U. S. Federal Communications Commission (FCC) on February 13, 1987. That petition requested that the FCC launch an inquiry into to the impact of advanced technologies on existing television broadcasting and the FCC's spectrum allocation policies relating to television. In response to that petition, the FCC adopted a Notice of Inquiry (NOI) on July 16, 1987covering a broad range of issues relating to over-the-air television service.

Three years later in 1990, after numerous proposals had been put forward for an Advanced Television System (ATV) for the country, the FCC made some initial decisions. It was decided that the new television system would use 6 MHz wide channels within the existing spectrum allocated for television in the United States. It was further decided that it was impractical to develop a system that would be backward compatible with the existing analog system. Therefore, in order to make a successful transition, a second channel would be required for each station, and during the transition period the new operations could not cause significant degradation to the existing service.

During the next several years, two intertwined projects were undertaken. On the one side was an enormous and competing effort to define the technical parameters for the new system. Yet at the same time a separate but unavoidably connected project was required to find available spectrum within the existing U. S. television bands to accommodate the new system's requirements without a significant disruption of the current service of approximately 1800 high powered stations. (It is noted that it was determined to be impractical at the time to also add a second channel for or to protect the existing facilities of several thousand low power stations.)

Finally in February of 1998, eleven years after the initial inquiry was begun, an all digital system (the initial proposals were all analog) had been defined, a table of channel allocations for the full power stations was finalized and construction of facilities could begin. At that time the transition to the all digital system and the termination of analog operation was very optimistically set to occur at the end of 2006. Even though a system had been defined and channels had been allotted, there was still an enormous amount of work to complete before the country could fully transition to digital. Stations had to be constructed, reasonably priced receivers had to be designed, the public would need to be educated and, more importantly, accept the fact that new broadcast transmission equipment would need to be purchased. In addition, a plan to transition the several low power stations to digital had not even been discussed.

The final transition has been further complicated by the fact that the amount of spectrum available for television broadcasting was to shrink by 108 MHz. Television channels 52 to 69 would not be available for broadcast use after the transition. Even though the current analog channels would be turned off and could be used to accommodate stations currently using spectrum between channels 52 and 69, this presented another challenge for the U. S. broadcast industry. Also, in the period after 1998, there was no criterion to determine which channels would become available since the requirements were only that a station would have to give up one of its channels.

As the 2006 date approached it was obvious that it would be impossible, because of numerous technical and political reasons, to meet that deadline. Therefore, a new deadline of February 17, 2009 has been established for shutting off full service analog broadcast transmission in the United States. No date has yet been set for the termination of low power analog operations.

In August of 2004, the FCC announced the procedure by which full power stations would elect the channel for digital (DTV) operation after the transition. The process would have three selection rounds beginning in December of 2004 with stations participating in the various rounds based on the following criteria.

- Round One - Station licensees with two in-core channels (channels 2 – 51) elect the channel they prefer to retain for digital broadcasting, and licensees with one in-core and one out-of-core channel (channels 52 – 69) elect whether to use their in-core channel for post transition digital operation.
- Round Two - Station licensees without a current in-core channel assignment elect a channel from those available after Round One.
- Round Three - Station licensees not yet assigned a channel, or assigned channel 2 through 6, may elect a channel from those available after Round Two.

Stations electing a channel other than their current digital channel would be required to provide interference protection for stations remaining on their digital channel or stations that had been given a tentative final digital channel in a pervious round. In addition, stations making elections in the same round would need to provide interference protection to each other.

Between each round, the FCC would announce which channels are protected, which are in conflict, and which are available. Station licensees with conflicts were required to decide whether to accept interference and remain on elected channels or move to the next election round.

After the third Round the FCC would then resolve any remaining conflicts and issue a Notice of Proposed Rulemaking proposing and seeking comment on the final DTV Table of Allotments.

At this time, Round 3 has been concluded and on October 20, 2006 the FCC released a Notice of Proposed Rule Making to finalize the post transition DTV table of allotted channels. Interested parties have until January 11, 2007 to file their comments on the proposed table and reply comments (comments on the initial comments) must be filed by February 12, 2007. After receiving and reviewing the comments the FCC will finalize the table.

Once the table is final, stations that are changing channel for post transition operation will be able to begin building their new facilities. At this point, it appears that more than 500 stations out of a total of 1800 plus stations will be moving to a new channel for post transition operation. Almost all of these new channels are currently in use by another station or adjacent to a currently occupied channel that will continue to operate until February 17, 2009. In addition there are the several thousand low power stations that will also need to be eventually transitioned to digital. These challenges will be discussed in future articles.

ATSC Work Progresses on DRL Standard

By Jerry Whitaker, VP of Standards Development,
Advanced Television Systems Committee, Inc.

The ATSC Specialist Group on Digital Electronic News Gathering (ENG) invites comments on a Candidate Standard that specifies the means for automatic transmitter power control of remote ENG links. This work, which began in February 2005 in the "TSG/S3" committee, is being led by Dane Ericksen of Hammett & Edison Consulting Engineers, who represents the Society of Broadcast Engineers (SBE) on this project.

An ATSC Candidate Standard is a document that has received significant review within a specialist group. Advancement of a document to Candidate Standard is an explicit call to those outside of the related specialist group for implementation and technical feedback. This is the phase at which the specialist group is responsible for formally acquiring that experience or at least defining the expectations of implementation.

CS/TSG-696, "Candidate Standard: ATSC Automatic Transmitter Power Control Data Return Link Standard," provides the necessary specifications to construct a Data Return Link (DRL) system for automatic transmitter power control (ATPC) applications. The document further specifies the mechanisms necessary for basic identification and power control of TV Broadcast Auxiliary Service (BAS) transmitters, in either an automatic or manual mode. In addition, the necessary mechanisms are described to permit the carriage of specialized private data (e.g., camera control information and operator communications) that are applicable to remote field production.

CS/TSG-696 was approved on May 10 and two months later an updated version, Revision A, was published that adds the means to uniquely identify TV BAS transmitters.

Table 1 DRL Channel Assignments

DRL Lower Band		DRL Upper Band	
Channel	Center Frequency	Channel	Center Frequency
		BAS Ch. A7 2109.5000 MHz (edge)	
1	2025.0125 MHz	21	2109.5125 MHz
2	2025.0375 MHz	22	2109.5375 MHz
3	2025.0625 MHz	23	2109.5625 MHz
4	2025.0875 MHz	24	2109.5875 MHz
5	2025.1125 MHz	25	2109.6125 MHz
6	2025.1375 MHz	26	2109.6375 MHz
7	2025.1625 MHz	27	2109.6625 MHz
8	2025.1875 MHz	28	2109.6875 MHz
9	2025.2125 MHz	29	2109.7125 MHz
10	2025.2375 MHz	30	2109.7375 MHz
11	2025.2625 MHz	31	2109.7625 MHz
12	2025.2875 MHz	32	2109.7875 MHz
13	2025.3125 MHz	33	2109.8125 MHz
14	2025.3375 MHz	34	2109.8375 MHz
15	2025.3625 MHz	35	2109.8625 MHz
16	2025.3875 MHz	36	2109.8875 MHz
17	2025.4125 MHz	37	2109.9125 MHz
18	2025.4375 MHz	38	2109.9375 MHz
19	2025.4625 MHz	39	2109.9625 MHz
20	2025.4875 MHz	40	2109.9875 MHz
BAS Ch. A1 2025.5000 MHz (edge)			

About DRL

In the 10 November 2003 ET Docket 95-18 Third Report and Order, the FCC adopted a suggestion of the Society of Broadcast Engineers to create two 500-kHz wide data return link (DRL) bands at the lower and upper edges of the re-farmed 2,025–2,110 MHz TV Broadcast Auxiliary Service band. A total of forty 25-kHz wide DRL channels were created, twenty in the lower DRL band, and twenty in the upper DRL band. (See Table 1.) These channels may be used to support important new applications relating to remote station operations.

The DRL channels permit a "feedback" or "return" link to be established from an ENG receive only (ENG-RO) site to an originating TV pickup station (i.e., an ENG truck). This link allows automatic transmitter power control by ENG trucks, and more efficient usage of the seven 2 GHz TV BAS channels. ATPC is the application addressed by CS/TSG-696.

Complimentary applications relating to remote production, such as camera control and operator communications, are also envisioned but are not included in this standard. It is important to note that "return" as used here is not limited

to signals going from the receive site to the remote location. The data might also go the other way. As such, the channels could also be used for two-way data communications, camera intercom, control functions, and so on.

The ATPC Application

Because the ET 95-18 Report and Order did not adopt technical or operating rules for DRL channels, there was, accordingly, a need for the appropriate technical specifications to be developed. Elements addressed by CS/TSG-696 relating to ATPC include:

- Basic system parameters; e.g., modulation type, occupied bandwidth, radiated power, emission mask, and frequency stability.
- Protocols and signaling. Established communications protocols are used where possible.
- Operational issues; e.g., data transmitted, priority of messages, and station identification.

With proper implementation of a DRL ATPC system, only the necessary amount of ENG output power is utilized to achieve reliable transmission. This facilitates more efficient use of the current ENG spectrum by minimizing the likelihood of interference among users in a given market or geographic location. It should be noted that any location may become frequency-congested in response to a major news or sporting event.

It is important to emphasize that the applications for DRL systems extend beyond strictly news events. Related and complimentary applications include coverage of sporting events (e.g., golf tournaments and motor races) and remote field production (e.g., parades and political conventions).

About CS/TSG-696

The DRL system described in CS/TSG-696 is intended to serve as a 2 GHz microwave return link from the ENG central receive site to the ENG truck in the field. The link is used to supply return power control metrics and other applicable information vital for remote ENG communications. The DRL system is also intended to facilitate various applications useful for remote field production, which may be specified in a future revision of the document or left to individual users and/or vendors to develop.

For the ATPC application, the DRL system consists of a 2 GHz DRL microwave transmitter and antenna situated high atop the central receive site or any other microwave-friendly environment. The microwave transmitter is supplied DC and control information via a specified cable interface. A 2 GHz DRL receiver is utilized at the ENG truck, which interfaces with the ENG transmitter.

DRL System Control Metrics

If an ENG truck (or other ENG platform) is equipped with a DRL receiving system, the DRL receiver will typically interface to the ENG transmitter to allow for ATPC by the ENG truck transmitter. Such ATPC is especially important in congested ENG markets, where split-channel operation using COFDM signals with 6-MHz wide pedestals are most likely to be used, in order to increase the effective channel capacity from seven to fourteen channels.

For split-channel operation, it is particularly important that the desired-to-undesired (D/U) signal ratio between the two incoming signals be close to zero dB. If one originating ENG truck is close to an ENG receive-only site, but the other truck is not, the DRL signal can be used to reduce the transmitter power of the close-in truck so as to match the received carrier level (RCL) of the COFDM signal from the distant ENG truck.

This balancing of RCLs applies to both a single ENG-RO site, where two split-channel COFDM signals are attempting to

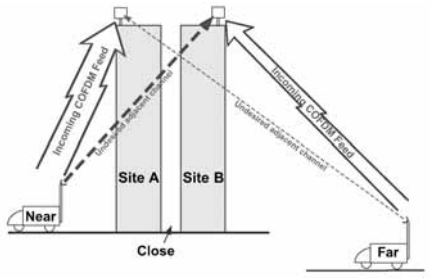


Figure 1 ENG-RO site without ATPC via DRL.

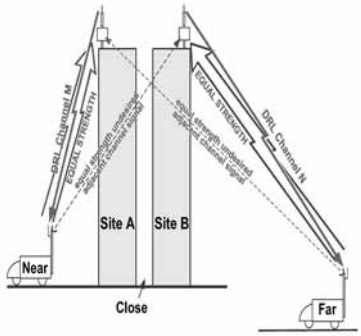


Figure 1 ENG-RO site without ATPC via DRL.

simultaneously feed a single site, and to separate but nearby ENG-RO sites of two different TV stations. In congested TV markets, it is to the mutual advantage of even competing TV stations to cooperate on the technical operations of their respective ENG operations, especially when adjacent home-channel frequency assignments are involved. Figures 1 and 2 demonstrate this concept.

Participate in the Work

The DRL Candidate Standard is available for download at no cost from the ATSC Web site (http://www.atsc.org/standards/cs_documents/CS-TSG-696r1.pdf.) Comments are invited from all parties (cs_amend_editor@atsc.org). The document is will be considered for balloting as a Proposed Standard (the next step in the approval process) at the December 13 ATSC Technology and Standards Group meeting. Comments should be submitted before that date.

A Fresh Look at Fessenden's 1906 Broadcast

By James E. O'Neal

Christmas Eve, 2006 is a very special date. According to many accounts, it marks the 100th anniversary of broadcasting. On that cold winter night, Reginald Fessenden, CE and COO of the National Electric Signalling Company, spun up a high speed alternator in his Brant Rock, Mass. laboratory until it was producing a carrier of approximately 70 KHz. He amplitude modulated this signal by simply connecting a carbon microphone in series with the antenna feeder. At the appointed time, Fessenden presented a special program consisting of recorded and live music, as well as a scripture reading celebrating the birth of Christ. At the conclusion of the transmission, he advised his listeners (ship and shore radiotelegraph station operators) that he would broadcast again in one week.

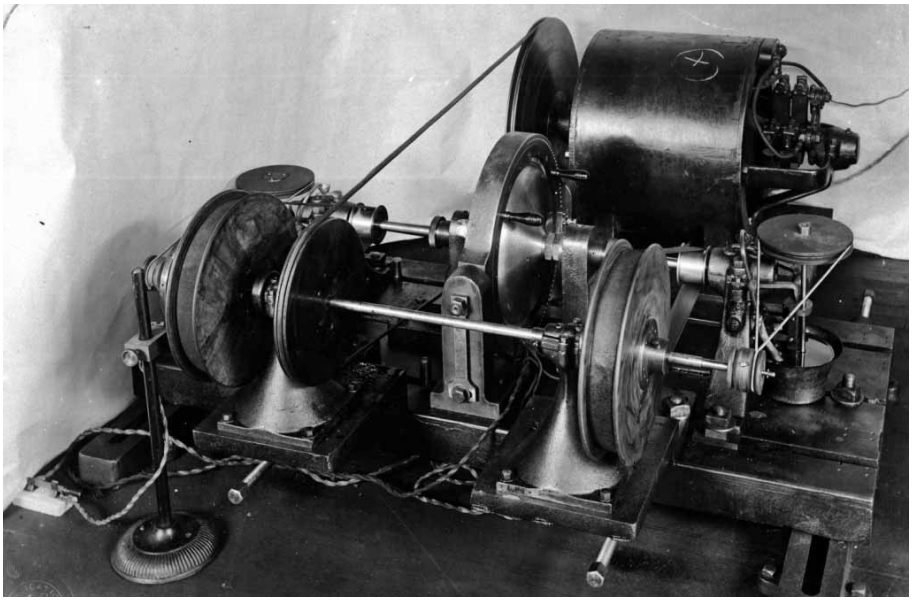
History had been made!

Broadcasting had been born!

I first discovered this account in the 1960s. Earlier this year, I accepted a freelance writing assignment to produce as story commemorating the events of December 24, 1906. Wanting to capture the event and setting as closely as possible, I embarked on a five month quest to learn as much about it and Fessenden as I could. The results of my research surprised even me.

First off, virtually every accounting of the event cites a biography of Fessenden published in 1940 by his widow, some eight years after his death. I wanted to read other accounts to try and get a better perspective of what led up to this seminal broadcast and also of the technology that made it possible. I was also curious to learn why Fessenden's relative success didn't produce a fairly quick rollout of broadcasting to the public. As we know, this did not happen until the early 1920s.

After months of reading and re-reading letters, memos, yellowed magazine and newspaper pages, and a very interesting log book kept by an early "amateur radio" enthusiast, I have concluded that the December 24th broadcast most likely did not happen!



Early high frequency alternator used by Fessenden and possibly used for the December 21, 1906 telephony demonstration. The ordinary twisted pair wire at the bottom left of the photograph appears to be used as an RF transmission line. Photo courtesy of North Carolina State Archives.

I'd like to share some of my findings. (A more complete accounting of my efforts appears in the October 25, 2006 issue of Radio World.)

First, I was not able to unearth any newspaper accounts of the event, which in itself was unusual. Fessenden thrived on publicity and was a very frequent contributor to both academic and popular publications. Fessenden's Brant Rock, Mass. Laboratory is only about 40 miles from Boston, so it would have been very easy to have summoned both a reporter and a photographer to document this event.

It's also curious that there appears to be no mention of the Christmas Eve broadcast anywhere before early1932, and no complete published record of it until 1940 and the posthumous biography—"Fessenden: Builder of Tomorrows" by his widow, Helen Fessenden.

As the capture of speech and music by radio receivers that heretofore only reproduced the buzzes and clicks of telegraphic code must have been very exciting for both shipboard radio room operators and their shore station counterparts, a lot of ink must have been applied to the pages of log books that particular evening. Unfortunately this can't be proved or disproved as a search for the radio log books from U.S. Naval vessels of that era revealed that apparently none were preserved. Only a single surviving contemporary radio log book was located. It was kept by one Francis Hart who lived in Sayville, N.Y., about 160 airline miles from Brant Rock.

Not too much is known about Hart, but from perusing the log book a few conclusions can be drawn—he knew radio and was interested in it; he was proficient at copying code; and he had quite a bit of time on his hands to pursue his hobby of listening in on whatever radio communications he could snare from his Sayville receive site.

The log is in the form of a commercial journal with sewn-in pages. It begins in September of 1906 and continues into October of 1909. Hart started each "listening" day with a rubber date stamp. Early in the log, he devoted several pages to listing "call identifiers" of various U.S. Naval vessels, as

well as those of known Marconi, United Fruit Company and De Forest. There was no FCC or even Federal Radio Commission then, so there were really no assigned station calls. Everyone operating used a two letter designation. Fessenden's Brant Rock station used "BO" which might have stood for "Brant on the Ocean."

Hart usually logged ship-to-shore and other traffic in his journal with just a listing of the identifiers of the two stations involved in the QSO (contact). Only rarely did he disclose details of the radio conversations intercepted. The exceptions are in themselves interesting. On one occasion, he records that a ship some distance from New York has radioed in to see if there has been a verdict in the much celebrated "Thaw" murder trial. Occasionally he comments on the weather or radio propagation conditions. He discusses upgrades to his station—an addition in 1907 of the newly invented crystal detector.

According to all published accounts of Fessenden's accomplishment, he went on the air in code a few days before Christmas Eve with a general call to anyone listening, and announced that he would be doing something special on Christmas Eve – transmitting speech and music.

With Hart's logbook at hand, verifying the Fessenden Christmas Eve story should have been easy.

I checked listings for a week or so prior to Christmas—nothing out of the ordinary.

Well, Hart was only human. Perhaps when Fessenden was transmitting his advisory, Hart was eating or napping. Even so, a message of this nature—speech and music through the ether—is bound to have caused a considerable stir among those that did have headphones in place. The "buzz" in its aftermath would have been slightly less than fierce.

"Didja hear that—speech and music on Christmas Eve—pass it on!!!"

However, there is no logging of any such "buzz."

The same is true for Christmas Eve. Only two QSOs are logged and neither involves Brant Rock.

If Fessenden had conducted his broadcast, it stands to reason that the post-showtime buzz also would have been tremendous, probably going on well into Christmas Day and beyond.

"Hey, were you listening last night? That fella Fessenden or whatever his name was playing music and talking on the air!!!"

But again, Hart's log contains no such entries. Traffic logged that week, on New Year's Eve, and on into January of 1907 reveals nothing unusual at all from any source.

A very valid question at this point is why would Fessenden have been in a position to attempt such a broadcast?

A few years before, he entered into partnership with two Pittsburgh businessmen to establish a telecommunications business—the National Electric Signalling Company, or NESCO. At the time, the only way to move telegraphic traffic across the Atlantic was via undersea cables. (Guglielmo Marconi claimed to have linked the North American continent with Europe in 1901, but in 1905-1906 did not have any sort of regular message handling service in place.)

Fessenden constructed the Brant Rock station and an identical one at Machrihanish, Scotland and by late 1906, the stations were communicating with each other.

Just at about the time that Fessenden and his business partners might have started to see a return on investment, a strong storm, aided by shoddy guy line work, took down the 420-foot tall antenna at Machrihanish. The date was Dec. 6, 1906.

At this point, one has to wonder what occupied Fessenden's thoughts more—preparing for a Christmas Eve broadcast or trying to come up with another business model for his company? (The Machrihanish station was never rebuilt. Employees were terminated and the equipment was sold off.)

The records show that Fessenden apparently was somewhat more focused on the future of NESCO, for on Dec. 11, he issued invitations to engineering personnel at Bell Telephone, Western Electric, General Electric, academics, and the press, to attend a demonstration of radiotelephony at Brant Rock on Dec. 21.

The Dec. 21 event is well documented and involved transmission of speech and music between Brant Rock and another NESCO station at Plymouth, Mass., some 11 miles distant.

Fessenden was attempting to sell the telephone company on using radiotelephony to extend the telco reach, as it did not require acquisition of rights of way or the stringing of wires. Fessenden even coupled his radio transmissions into the telephone lines with a special "relay" (hybrid) that he had designed.

Apparently the demonstration was very successful. So much so, that Fessenden penned an article describing it for Scientific American, which was published the next month.

His Scientific American description of the Dec. 21 event was detailed and contained pictures of the apparatus used.

Strangely, there is absolutely no mention of the Christmas Eve broadcast, even thought it "occurred" only three days after the demonstration.

Later, Fessenden wrote up a summary of all of his wireless telephony work to date. This was published in several places, including the AIEE Transactions and The Annual Report to the Smithsonian (1908). The account, as published in the Smithsonian volume, spans more than 40 pages and includes numerous pictures. The Dec. 21 demonstration is well documented therein. However, there is no word whatsoever about a Christmas Eve or New Year's Eve broadcast.

There is little evidence that NESCO made any money for Fessenden's backers and in 1910 he was terminated. For most of the next decade and a half, Fessenden was occupied in legal challenges to collect money for use of his patents by NESCO and later Westinghouse and RCA.

Among the rather large amount of Fessenden items at the North Carolina State Archives in Raleigh is a personal scrapbook of newspaper clippings. There are three clippings that call

attention to his early work in transmitting speech and music. None mention a Christmas Eve broadcast and all fix the date of his first attempt at broadcasting as sometime in 1907.

There are no clippings of any "letters to the editor" by Fessenden to rebut the date or circumstances described in the clippings.

Fessenden authored a series of articles for Hugo Gernsback's Radio News in 1925. The series was entitled "My Inventions." In the first installment, Fessenden prepared a "box" with "bullets" listing some of the accomplishments of which he was most proud. In the number five position is a listing for "wave chute" (his name for what became a counterpoise or ground plane). Sharing the number five position is "first radio broadcast 1907."

There is no discussion of the radio broadcast in the text of that article.

Gernsback ran a series of biographical articles on Lee De Forest concurrently with the Fessenden series. In the June issue of the magazine, De Forest states that he did the first broadcast of speech and music in early 1907 from a "studio" in the New York City area. (This is also mentioned in De Forest's autobiography, published years later.)

Interestingly, Francis Hart's log book bears an entry on March 20, 1907 that he was receiving speech and music from De Forest's NYC station. This is the first of several loggings that Hart would make in the coming months of the reception of speech and music.

Looking at the situation from another perspective, if the histories are correct and Fessenden actually did the 1906 broadcast, then the year 1931 would mark the 25th anniversary of the event. Radio was big business all over the world by that time and the event certainly should have been commemorated by the press. However, a search of radio related periodicals in this time frame turned up no mention at all.

A trade magazine that exists to this day was born in October of 1931. That publication was Broadcasting (now Broadcasting & Cable). Since its inception, the magazine has always been known for its thorough coverage of broadcasting-related news and events. Two issues were published in December 1931. Neither contains a single word about Fessenden. Curiously, the second December issue contains a fairly lengthy article about Marconi.

So where did the information about the Christmas Eve 1906 broadcast come from?

In a collection of letters at the Smithsonian, there is one from Fessenden dated January 29 1932. It is addressed to S.A. Kintner, a former associate of Fessenden and at the time, a VP at Westinghouse.

Fessenden's letter was apparently written in response to an inquiry from Kintner regarding Fessenden's early work in radiotelephony and broadcasting. This is an excerpt from that letter:

"…the program sent out Christmas Eve and New Year's Eve, 1906 would be the first broadcast. This broadcast being advertised and notified three days in advance of Christmas, the word being telegraphed to the ships of the U.S. Navy and the United Fruit Co., which were equipped with our apparatus that we intended broadcasting speech, music and singing on Christmas Eve and New Year's Eve."

The program on Christmas Eve was as follows: first a short speech by me saying what we were going to do, then some phonograph music. You will find a photograph showing the phonograph used in the article in the Transactions of the American Institute above referred to and also in the American Telephone Journal, the music on the phonograph being Handel's "Largo. Then came a violin solo by me, being a composition by Gounod called "O, Holy Night", and ending up with the words "Adore and be still" which I sang one verse of, in addition to playing the violin, though the singing, of course was not very good. Then came the Bible text, "Glory to God in the highest and on earth peace to men of good will", and we finally wound up by wishing them a Merry Christmas and then saying that we proposed to broadcast again New Year's Eve.

The Broadcast on New Year's Eve was the same as before, except that the music was changed and I got someone else to sing. I had not picked myself to do the singing, but on Christmas Eve I could not get any of the other (sic) to either talk, sing of (sic) play and consequently had to do it all myself.

Fessenden died approximately six months later on July 22, 1932. Sometime thereafter, his widow, Helen, lightly edited those paragraphs from the letter and included them in her husband's biography.

In truth, the Christmas Eve broadcast story is a beautiful thing. I had believed it for 40 years without any qualifications until I started my research earlier this year. I still would like to believe it, as on the surface it is a great story and provides a springboard for the whole institution of radio broadcasting. However, without hard evidence to support it, Fessenden's claim seems to be rather dubious..

Fessenden was truly a great individual. He patented some 500 inventions and did pioneering work in many areas. He invented the heterodyne principle of electrical signals long before Armstrong and even coined the work "heterodyne."

He may well have been the first person to transmit speech via radio and there is no disputing the fact that he had the technology available to so, and that he did do so on December 21, 1906. However, in light of the information available, crediting him with the Christmas Eve broadcast is not easily done.

I would ask that if anyone reading this has any hard evidence to the contrary, he or she should make it public. For detailed information, please see the October 25, 2006 issue of Radio World on the web at: http://www.radioworld.com/pages/s.0052/t.437.html

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James O'Neal graduated from the University of Arkansas. He retired in 2005 from the Voice of America with more than 36 years of experience in broadcasting. He is now Technology Editor for TV Technology Magazine. Mr. O'Neal holds an Extra Class Radio Amateur License (AG4DH) and is a member of the IEEE, BTS, SMPTE and SBE.

100th Anniversary of the Vacuum Tube

By James E. O'Neal

The device that heralded the beginning of the 20th century electronics industry first saw the light of day in late 1906. This was the triode electron tube, or audion, as its inventor called it.

To those of us who lived and worked with vacuum tubes at least some time during our careers, Lee de Forest's invention seems both simple and obvious: a glowing metal filament (cathode) provides a source of electrons that are attracted to a positively charged plate or anode (de Forest initially called it a "wing"). Interposed between the cathode and anode structures is a "less than solid" grid. (The grid in the original tube was simply a piece of wire bent back and forth in a zigzag manner. It later evolved into a more efficient helix of wire surrounding the filament or cathode.)

By varying the voltage on the grid, the stream of electrons being drawn to the anode is modulated. A small grid voltage can effect an appreciable change in a plate circuit load resistor and the voltage developed across it. It amplifies!

Simple!

However, it took a patent lawsuit to force its invention, five to six additional years to turn it into a practical device, the work of another fabled engineer to explain its workings, and several legal skirmishes to clear the path for its commercial use.

The concept of the electron tube goes back quite a bit before de Forest. Geissler tubes, Crookes tubes, Lenard tubes, x-ray tubes, early cathode ray tubes, and others all involved sealing metal electrodes into a glass envelope or tube and removing a certain amount of air from the space inside.

It Began with Edison

Thomas Edison must be given credit for the creation of the "hot cathode" tube—he sealed a metal plate inside one of his electric lamps and noted a

An early de Forest audion (from O'Neal Collection)

unidirectional flow of current when the lamp's filament incandesced. He received a patent on this "Edison effect," but did not try to commercialize it, or spend much time in trying to understand what was happening.

Later, a British scientist, John Ambrose Fleming decided to try it out as a detector of radio frequency energy and learned that it worked very well for that purpose. He dubbed it the "oscillation valve" and received a patent on his discovery. (Electron tubes have always been known as valves in England.)

Enter Lee de Forest

After graduating from Yale's Sheffield Scientific School in 1899, de Forest had hoped to work in Nikola Tesla's laboratory, but received no offer. Instead, he moved through a series of low paying introductory positions in the field of telephony and wireless before meeting a less-than-honest stock promoter, Abraham White. In a very short time, White had incorporated the de Forest Wireless Telegraph Company in New Jersey, with himself as president and with young de Forest serving as vice president and scientific director.

In truth, White was much more interested in making money than furthering the state of the art of wireless communications, but had to have something to show potential investors, so a number of wireless telegraph stations were constructed in the Eastern United States. The company set up a particularly impressive display of wireless at the 1904 St. Louis World's Fair.

Reginald Fessenden

Many problems beset the operation of the de Forest Wireless Telegraph Company. Among these was legal action taken by Reginald Fessenden over de Forest's unauthorized use of Fessenden's electrolytic detector. In 1906, after three years in the courts, Fessenden was awarded a judgment and effectively put the de Forest company out of business. White was quick to reorganize under another name and transfer assets, so as to deny Fessenden the monetary penalty the court assessed. There was no place for de Forest in this new venture; he was terminated with a very small amount of severance pay and a solitary invention he'd been working on that White believed to be worthless. This was a detector of radio waves that did not infringe on Fessenden's device.

Exactly how de Forest arrived at his idea for a detector is a matter of conjecture. As mentioned, Edison had discovered that a negative charge could move through the empty space in his specially constructed electric lamp. Later, Fleming adapted this principle to demodulate RF energy and published his findings in 1905.

With Fessenden's lawsuit looming, It is to be imagined that de Forest quickly began searching for other technology to replace that crucial (and borrowed) part of the radio system he was using.

By his accounting, de Forest had first tried detecting radio signals by placing electrodes in an open gas flame. While this worked, the detector

was only as stable as the air currents around it and could not be transformed into a commercial device.

It could be assumed that de Forest made the crucial "jump" in his road to invention by replacing the gas flame with an electrical one, sealed within a glass shell.

Enter Henry McCandless

It is reported that in the fall of 1906, Henry McCandless, a New York City manufacturer of small electric lamp bulbs, was approached by an assistant of de Forest's and asked to fabricate what amounted to a Fleming valve.

In a matter of weeks, de Forest unveiled his latest development at a meeting of the American Institute of Electrical Engineers (AIEE) in New York City. The date was October 26, 1906. De Forest used the word "audion" to describe this new detector.

At this point in time, it appears that de Forest had merely reverse engineered yet another invention.

However, within the month, he enhanced the oscillation valve or audion into something unique and patentable.

How de Forest came upon the idea that jumpstarted the electronics industry will probably never be known with certainty. Why he did it may be clear in light of the audion's closeness to Fleming's valve.

De Forest had experimented with using multiple electrodes in his flame detector experiments. Perhaps this was the genesis of his invention. Perhaps not.

He had also been experimenting with the use of a battery, or batteries, in connection with the Fleming diode. Perhaps he was curious about what would happen if he used multiple electrodes as he had done in the flame detector. Perhaps he just wanted to make it appear to be something other than a direct knock-off of Fleming's device. His exact reasons will never be known.

During that November, in an attempt to either replicate his work with the flame detector, or possibly to make his device different from Fleming's, de Forest sought a patent on a device that consisted of a filament, an anode, and a control electrode of sorts (not a grid). Such a tube could not have provided de Forest with any useful gain. (However, years later, this principle of "gridless control" was successfully adopted by Heintz & Kaufman Ltd. and was the basis for their "Gammatron" tubes.)

De Forest kept up his experimentation and on November 25, 1906, he had McCandless incorporate a grid structure into the experimental lamp devices he'd been ordering.

Stroke of Genius?

Was it a stroke of genius, or just a plodding attempt to avoid infringement on Fleming's detector?

It doesn't really matter. This was that bit of tinkering, experimentation, innovating, developmental engineering, or just plain luck that put de Forest over the top.

This was that one small step that immortalized de Forest and placed him among the top inventors of the 20th century.

Instead of merely detecting, the addition of the third element allowed the audion to amplify. If it could amplify, then it could oscillate. The possibilities for the new device appeared to be nearly limitless.

However, all of this was to come somewhat later. At the end of 1906, the audion was far from perfect and de Forest was woefully ignorant as to how it worked. This is so stated in his patent application.

He assumed that ionized gas was somehow involved in moving charges through space, hence the name aud–ion. In fact, he rationalized that if too great a vacuum were to be created in processing the audion, the tube could not work.

This resulted in the audions produced by McCandless being quite gassy and of limited use. (The chief customers were radio amateurs, and the early tubes sold for $5.00) If more than a few tens of volts were applied to the wing (plate), then the residual gas would ionize and render the tube useless until the potential was removed.

Also, carbon and/or pure tungsten are not the most copious electron emitters and early adopters of de Forest's triode would frequently burn out the filament in their efforts to squeeze more performance from the little amplifier, resulting in product returns to McCandless.

For this and other reasons, McCandless was not that excited about manufacturing audions for de Forest, but continued to do so for some time. He was in part responsible for several changes and improvements to the audion over the next several years.

It took Edwin H. Armstrong to fully analyze the operation of the de Forest audion and put forth the correct theory of its operation.

De Forest eventually sold rights to his invention. Engineers and scientists at both Western Electric and General Electric "took it from there" and shaped the primitive little device into the workhorse that drove the radio, recording, television, computing and numerous other industries until the invention of the transistor began to eclipse it more than 50 years later.

De Forest was honored in 1922 with the Institute of Radio Engineer's Medal of Honor in recognition of his invention and other work in the field of radio.

Later in his life, de Forest served a term as president of the IRE (1930) and in 1946 received the AIEE's Edison Medal for his development of the vacuum tube.

Although de Forest died at the age of 87 in 1961, his invention lives on to this day. Even though the vacuum tube is officially 100 years old now, it has not been completely forgotten and pushed out of the way. Several companies throughout the world still manufacture tubes and many audiophiles claim that tube technology is the only way with which to reproduce high quality audio.

Happy 100th birthday!

Japan IEEE BTS Chapter Report

By Keiichi Kubota, NHK, Japan Broadcasting Corp., Japan.

BTS Japan Chapter had two joint meetings with the Institute of Image Information and Television Engineers (ITE) during the second half of 2006.

On July 28 to 29, 2006 at Hokkaido University, Sapporo, Japan. There were 13 technical presentations on transmission technologies for digital terrestrial broadcasting and general topics for broadcasting technology and one special topic for emergency warning broadcasting system.

On October 3, 2006 in Tohoku University, Sendai, Japan. There were 4 technical presentations on digital broadcasting technology and one special topic for universal communication.

BTS Japan Chapter is planning to have three joint meetings with the Institute of Image Information and Television Engineers (ITE).

- On January 16 to 17, 2007 in Kumamoto University, Kumamoto, Japan.
- On February, 2007 in NHK Hiroshima Station, Hiroshima, Japan.
- On February 23-24, 2007 in Kyuka-village Minami-izu, Shizuoka, Japan.

Taipei IEEE Broadcast Technology Society Chapter Report

By Ying Li, Yuan Ze University, Taiwan

The Eleventh Cross-Strait Radio Technology Seminar, jointly sponsored by the China Radio Association, IEEE BTS Taipei, Yuan Ze University and Tatung University in Taiwan, and the Electronics Society of Hunan was held on September 9th and 10th at Changsha, Hunan, China with the joint efforts of participants from both sides of the Taiwan Strait. The attendees, a group of over forty from Taipei and over sixty from Hunan, including students, teachers, engineers and government officials. Speeches were given on various topics of current status and future trends. Hunan currently has 85% radio and 93% television coverage, is 16th in software and 8th in IC industries in China. Changsha's Lu Valley industrial park is rapidly developing, gaining a leading position in central China. Representatives from Hunan University gave speeches on wireless sensor network design and implementation. Representatives from Taiwan gave speeches on the future of internet telephony, electromagnetic field analysis for cell phones, channel modeling and system deployment for mobile phone systems (cell phone penetration rate in Taiwan is over 100%).

The after seminar tour included a visit to the Lu Valley industrial park (we visited San-yi heavy machinery, San-chen motion pictures) and a visit to the spectacular Zhanjiajie.

Attendees of the Seminar include the Deputy Governor of Hunan and other officials.

Attendees from Academia (four universities) and Industries, including six BTS, Taipei members.

Zhangjiajie is well known for its spectacular scenery. A broadcasting station on top of Tienmenshan with six microwave antennas and an eighty eight meter tower is maintained by fourteen hardworking engineers.

Report of the IEEE Joint BT/CE/COM Russia Northwest (St.Petersburg) Chapter

By Dmitry Tkachenko, St. Petersburg State Polytechnic University, Russia

A technical meeting of the Russia Northwest BT/CE/COM Chapter was held at the MART Company in St.Petersburg on 10 November 2006. The meeting focused on a discussion of current issues related to development of digital TV and radio broadcasting technologies in Russia and a discussion about the results of recent international conferences ISCE 2006 and IBC 2006.

Dr. Alexander Artamonov, Deputy Director of the MART Company, who traditionally plays a key role in organizing Chapter meetings, opened the meeting by presenting an overview of the current situation concerning terrestrial digital TV and radio broadcasting in Russia. Three digital terrestrial TV channels are operational now in St.Petersburg and terrestrial DTV broadcasting is now available in some regions of Russia. The Government Commission headed by the First Deputy Prime Minister of the Russian Federation, Dmitry Medvedev, was established in Russia to develop a strategy and concepts for introduction of digital TV in Russia. Two possible approaches are being considered; one based on governmental support for a transition to digital TV and the other is based on possible investments from private business. In either case it is expected that a basic social DTV package consisting of several major channels should be delivered to TV viewers free of charge. No clear business motivation exists for terrestrial broadcasters to start DTV broadcasting because the Russian population is used to receiving many free analog TV terrestrial channels. The introduction of digital terrestrial channels with paid subscriptions does not attract serious interest from customers. On the other hand, the participants at this meeting observed that penetration of digital TV cable networks is growing in Russia and that commercial IPTV projects are also available for providing reception of interactive TV programs via ADSL modems or appropriate set top boxes.

In the field of digital radio broadcasting Alexander Artamonov proposed to focus more effort on the development of equipment for DRM broadcasting. At this time a pilot DRM broadcast is on air in three Russian cities in both short wave and medium wave frequencies. At these sites the DRM signal is produced by equipment manufactured by the Thales Company with final amplification provided by existing Russian transmitters adjusted for the DRM broadcasting mode. The goal of the current DRM test broadcasts is to identify the areas which have clear reception of the DRM signal and to measure the received signal quality in each area. The Chapter meeting participants agreed that the issues related to DRM broadcasting are of practical interest at this time. They decided to continue discussing these issues at the next Chapter meeting.

The Department Head of the St. Petersburg State Research Institute of Television, Dr. Lev Balanin, gave a presentation describing the Multifunctional Digital TV Complex developed and manufactured by the Institute. It includes a vehicle-based TV studio and a capability for transmitting the TV signal to central broadcast facilities. All connections within modules are based on serial digital interfaces (SDI). The output signal can be configured to be in a PAL or SECAM analog format or in an MPEG-2 transport stream digital format. Possible usage of MPEG-4 AVC compression is also being considered for the future. Transmission equipment for satellite uplink or radio relay microwave link is available in a separate vehicle.

The second part of the meeting was devoted to a discussion concerning recent international conferences. Prof. Konstantin Glasman briefly described the results of International Symposium on Consumer Electronics ISCE 2006 held in St.Petersburg in summer 2006 (see the report on this symposium in the Fall 2006 issue of the BTS Newsletter). He also reported on the main technology trends he observed during his recent visit to the IBC 2006 conference held in Amsterdam during September 2006. Konstantin Glasman noted three main themes at the IBC 2006 conference. They are (1) HDTV, (2) IPTV and (3) mobile TV. He described in detail the main technical developments discussed at the IBC conference for each of these technical areas.

At the conclusion of the meeting, the Chapter Chair, Dmitry Tkachenko, reminded Chapter members to submit their 2007 IEEE Membership Renewals on time as well as to possibly recruit new IEEE and BTS members. The meeting participants were very pleased to know that the Fall issue of BTS Newsletter contains an article with congratulations to Alexander Artamonov who celebrated his 70th birthday on July 1, 2006.

The meeting was followed by a Chapter sponsored dinner. During the dinner the participants mentioned the 75th anniversary of TV broadcasting in Russia which is officially being celebrated in Russia now with a series of corresponding events for TV professionals. Regular TV broadcasting in Russia based on an optic-mechanical TV system was launched in 1931. It was followed a few years later by electronic TV broadcasting. During the dinner the members of the Chapter had personal discussions on various technical and professional issues related to broadcasting.

The ITU-T IPTV Focus Group Second Meeting

by Wei LI, Communications Research Center, Canada

The second meeting of IPTV focus group (FG IPTV) was held by ITU-T in Busan, Korea from Oct. 16 to 20, 2006. This meeting attracted more than 200 participants from most of the world's leading telecom equipment manufactures (including Alcatel, Lucent, Nortel, Motorola, Samsung, Cisco, etc.), telecom service providers (France Telecom, Korean Telecom, China Telecom, NTT, etc.) and other organizations working in the field of IPTV (ETRI of Korea, ATIS, RNIB of UK, ITU-T SG (Study Group) 13 for Next Generation Networks, CATR, DTI, etc.). More than 150 contributions were received prior to the meeting. Their distribution is as follows:

- WG 1 (Architecture and Requirements): 104
- WG 2 (QoS and Performance Aspects): 15
- WG 3 (Service Security and Contents Protection): 15
- WG 4 (IPTV Network Control): 16
- WG 5 (End Systems and Interoperability Aspects): 10
- WG 6 (Middleware, Application and Content Platforms): 13

Some contributions addressed issues of more than one working group. They were processed simultaneously by corresponding working groups. This situation is counted in the above statistics.

19 incoming liaison documents were also addressed by relevant working groups.

The leadership team of this meeting was as follows:

Chairman: Mr. Ghassem KOLEYNI (Nortel Networks)

Vice-Chairmen:

- Mr. Simon JONES (BT)
- Mr. Chae-Sub LEE (ETRI)
- Ms. Duo LIU (China Academy of Telecommunication Research, MII)

WG 1: Architecture and Requirements

- Mr. Junkyun CHOI (Information and Communications University)
- Mr. Christian JACQUENET (France Telecom)
- Mr. Julien MAISONNEUVE (Alcatel)

WG 2: QoS and Performance Aspects

- Mr. Paul COVERDALE (Huawei)
- Mr. Juergen HEILES (Siemens)

WG 3: Service Security and Contents Protection

- Mr. Dong WANG (ZTE)
- Ms. Catherine PERGUE (Dell)
- Mr. Glenn ADAMS (Samsung Electronics)

WG 4: IPTV Network Control

- Mr. Daegun KIM (KT)

WG 5: End Systems and Interoperability Aspects

- Mr. Yan CHEN (China Telecom)
- Mr. Gale LIGHTFOOT (Cisco)
- Mr. Yoshinori GOTO (NTT)

WG 6: Middleware, Application and Content Platforms

- Mr. Masahito KAWAMORI (NTT)
- Mr. Charles SANDBANK (DTI)

During the five-day meeting, each working group worked separately on their own mandates. Due to the uneven distribution of the contributing documents, the work load of different groups varied very much. The Architecture and Requirements working group (WG 1) had to work very hard to fulfill its mandates. WG 1, with the most numerous participants (usually more than 150 people), had to work the entire five days and most evenings until late night. Other working groups were relatively relaxed and they were not fully loaded every meeting session during this period.

I spent most of my time on WG 1 and WG 2 activities.

WG 1 meetings spanned from Monday (Oct. 16) through Friday (Oct. 20) morning. Due to the heavy work load, evening sessions had to be scheduled from Tuesday to Thursday evenings. Contributing proposals responding to the call for contributions of last FG meeting can be classified into following categories:

- Term of references including definition
- Requirements of IPTV
- Architecture of IPTV
- Service and scenario of IPTV

More issues, as defined in the last meeting were addressed, they include:

- IPTV requirements: outstanding issues on the requirements for IPTV services contained in the living list were further addressed. Specifically, the user requirements, network/service provider requirements, and content provider requirements were discussed. The alignments with architecture and service scenario for IPTV service were addressed. To produce relevant architecture and service scenarios for IPTV service, specific requirements were defined at this meeting.
- IPTV architecture: populated the output documents, chiefly the architecture document. Joint meetings with other groups were held to align the considered architectures.
- IPTV service/scenario: according to the call for contributions of the last meeting, the following contributions were processed:
  - The refined list and definition of IPTV services
  - Identified services grouping and classification by importance, relevance, priority, etc. to identify phases of work (possibly core set, additional services and rejected services)
  - Work on requirements, use cases and service scenarios

WG 1 discussions have taken place on three subgroups of requirements, architecture and service/scenario for this meeting. The following are more detailed observations on the WG 1 activities.

Requirements of IPTV

Requirements of IPTV describe requirements for the design, the deployment and the operations of IPTV services. IPTV service requirements, accessibility requirements and QoS (Quality of Service) requirements

are some examples.

Intensive discussions were carried out on the IPTV service requirements issues. Lucent (Input Document (ID) 0254) and DTI (ID0109) suggested adopting a quite mature requirements document from ATIS to prevent re-investment. After discussion, it was agreed that the ATIS documents will be a basis to develop the output documents on the requirements for IPTV service as a starting point. Some items from ATIS were used directly to develop the output document.

ETRI proposed (ID0130) a remote content sharing service. The remote content consists of media content and remote UI (User Interface) content. By eliminating proprietary software and hardware for playing digital content on home-entertainment systems, the UPnP standard opens considerable opportunities for software and hardware developers. This is an interesting requirement for the IPTV service. It could be further investigated to see if it can be used in our actual mobile TV quality testing project. For this proposal, content protection concerns were raised.

ZTE proposed (ID0154) to both WG 1 and WG 4 some multicast control requirements, including channel zapping protocol, channel access control and channel review capability, for broadcast TV service in IPTV. These were included into the output document with other control requirements. Other multicast related requirements of IPTV can be seen in proposals such as: The Requirement for the Multicast Feature of IPTV Bearer Network (ID0165, from ZTE), Requirements for Overlay Multicast based IPTV Media Delivery System (ID0221, from ETRI), Proposed Requirements for interoperability amongst IPTV Multicast Service Providers (ID0136, from KT), etc.

One interesting proposal from ETRI (ID0189) suggested a minimal requirement of H.264 stream for encapsulation of MPEG-2 TS (Transport Stream). It proposed a simple way to put timing information in the H.264 sequence, instead of using the MPEG-2 PES-header to record the PTS (Presentation Time Stamp) and DTS (Decode Time Stamp). By means of the proposed methodology, it is possible that the packetization of MPEG-2 TS into H.264 can be more effectively performed.

During the output document preparation stage, many discussions were concerned about the terminology of general requirements for IPTV, such as using generic 'content' to avoid the term 'TV program', using 'audio' instead of 'voice', etc.

On the last day, a 65-page output document was created for IPTV requirements.

Architecture of IPTV

The architecture sessions of the Working Group 1 worked on 27 submissions.

Based on contribution documents (ID0117, ID0118, ID0120 of Huawei, ID0209 of Nortel, ID0156 of ZTE, ID0230~0232 of NTT, ID0240 of TelecomPolska), WG 1 concluded that three options are available for providing IPTV services: NGN (Next Generation Networks) IMS (IP Multimedia Subsystem)-based, NGN non IMS-based and non-NGN based. There was agreement within the Focus Group that the first two options will be fully aligned with the NGN architecture defined by SG13 and provided in the liaison statement. At this point, no potential misalignment was detected. WG 1 will ensure that any requirements relevant to the NGN work are liaised on time to SG13 so as to ensure the work of the focus group is aligned with SG13.

With some modifications to a contribution document entitled: IPTV Functional Architecture (ID0170, from China Telecom, MII), a high level architecture of IPTV was included in the output document. This architecture is shown in the diagram (Fig. 1) below:

Information across each reference point is listed as following:

- A: Content Stream
- B: Content Request, Descriptive Metadata/Content Info etc.
- C: Rights Management Interaction
- G: Conditional Access System
- D: Service Interaction Message
- E: Content Location Info, Billing Info., Content Control Command, etc.
- F1: Play Control Signal
- F2: Content Stream

ZTE proposed (ID0156) an IMS-based architecture for IPTV. In this proposal, IMS is selected as the core service component and supports many capabilities to realize various services in NGN. By adding a new functional entity in IMS, this document gives an

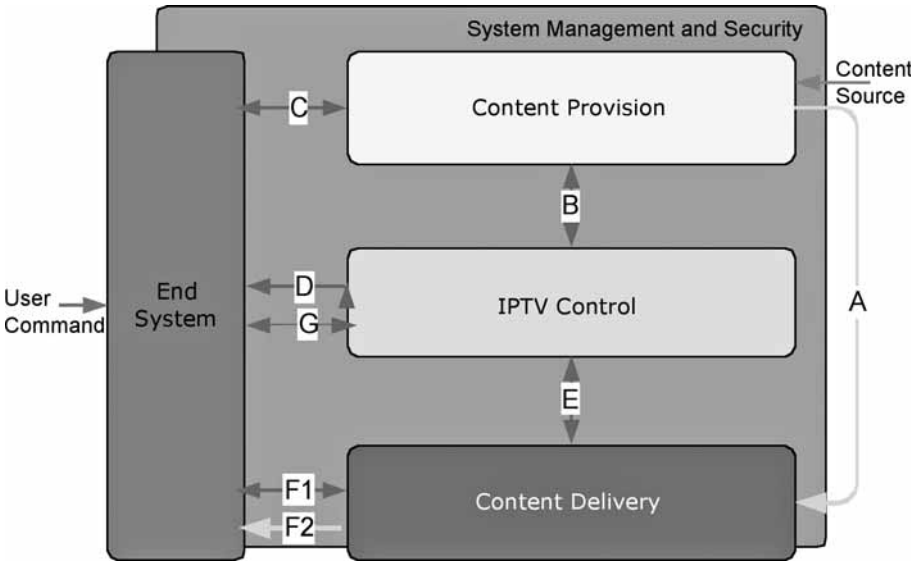

Fig. 1. High level architecture of IPTV

IMS-based IPTV architecture. Nortel's proposal (ID0209) and TelecomPolska's proposal (ID0240) also belong to the IMS-based architecture.

Many proposals concerning the IPTV architecture introduced controversial diagrams which could cause conflicting meanings. It was suggested that these diagrams be simplified or deleted. Replacing some lower level diagrams with higher level illustrations was also suggested to clarify and facilitate understanding.

The schedule was extremely tight. An appropriate review of the output document was not accomplished. Some delegates complained about the lack of time. The chairman had to write a note to defer the approval of this part until further discussions during the electronic meeting in December this year.

Service and scenario of IPTV

The IPTV service and scenario identifies and defines IPTV services. The IPTV services are classified and their requirements defined. User cases for IPTV services are also provided.

The service and scenario sessions of the Working Group 1 worked on 25 submissions.

Due to time restrictions, Service and Scenario of IPTV has little time to produce any approved documents. It was suggested to resume its discussions during the May 2007 meeting, since the January 2007 meeting has a full schedule of materials to process.

On the last working day, WG 1 finished producing seven output documents. One liaison statement to SG13 was also generated.

The QoS and Performance working group (WG 2) worked during the first 3.5 days by reviewing the assignment of incoming documentation and incoming liaison documents, progressing on existing work items. During this period, WG 2 finished generating four output documents:

- QoE requirements for IPTV
- Traffic management for IPTV
- Application layer reliability solutions for IPTV
- Performance monitoring for IPTV

The following are the major activities resulting from processing the existing work items:

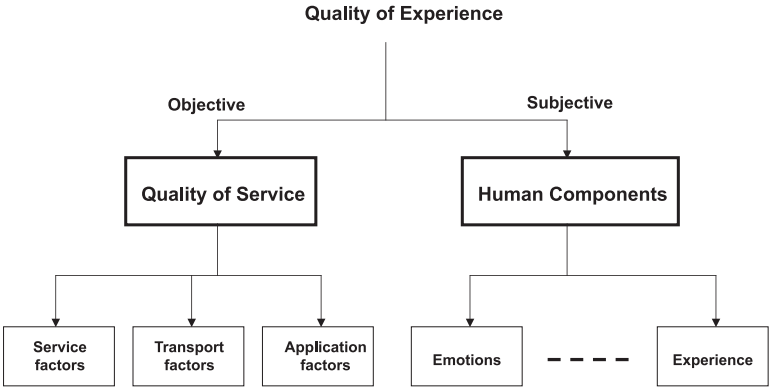

Fig. 2. QoE Dimension

QoE requirements for IPTV

Proposed by Nortel (ID0210) and after discussion, an agreement was reached towards the QoE (Quality of Experience) dimension model as shown in the following diagram (Fig. 2).

Differing from some other view points, QoE is regarded as the overall acceptability of an application or service. It includes the complete end-to-end system effects (client, terminal, network, services infrastructure, etc) and may be influenced by user expectations and context. Hence the QoE is measured subjectively by the end user and may differ from one user to the other.

QoS, which is an objective service performance measure, is considered as one component contributing to QoE. Another part of QoE consists of human components which may include emotions, linguistic background, attitude, motivation, etc. This QoE shows a slightly different concept when compared with the QoE we presented in the IPTV tutorial given at the 2006 IEEE BTS Broadcast Symposium.

There were suggestions to put service billing under Human Components.

Traffic management for IPTV

Huawei proposed (ID0123) an IPTV multicast services traffic management mechanism based on functionalities over NGN. In order to provide Multicast QoS in the current model, it is proposed to add a new reference point between the NGN control blocks.

Nortel proposed (ID0211) a template for video coding and transmission over IP networks, including MPEG2 transport packet and H.264 packet transmission with RTP. There was a suggestion to include additional coding and mapping based on input.

The ITU-T Recommendation Y.1541 for Network Performance Objectives for IP-based Services was adopted to define classes of network Quality of Service (QoS) with objectives for Internet Protocol performance parameters. The association of IPTV services with Y.1541 classes was discussed. The mapping of Y.1541 QoS classes on IPTV services was defined. It was noted that the list and definition of IPTV services still needs to be clarified further according to the WG1 work progress on defining IPTV services. Thus, this table should be updated after the service list and each IPTV service scenarios are clearly defined. The identified services are examples pending WG 1 outcome.

Application layer reliability solutions for IPTV

ARQ (Automatic Repeat Request), FEC (Forward Error Correcting) and Hybrid were identified as schemes to recover packet losses during the delivery of data over networks. ARQ-based error control scheme is a good candidate to support application layer reliability for soft real-time streaming and interactive user service in IPTV. ETRI (ID0220) proposed three ARQ standardization activities which can be well applied to

IPTV services. These include the ITU-T X.607 (ECTP-3), ITU-T X.608 (ECTP-5) and IETF RFC 3940 (NORM). Further adaptations for IPTV applications were requested.

ETRI (ID0219) also analyzed the use of application layer reliability solutions according to IPTV service type, since various types of IPTV data need different error control schemes according to their inherent characteristics. While the real-time streaming data is well handled by FEC-based error control schemes, soft real-time streaming and interactive user services are well handled by ARQ-based ones.

Performance monitoring for IPTV

ZTE (ID0152) introduced some opinions on monitoring points and monitoring methods towards IPTV performance monitoring. It also introduced opinions on service monitoring contents and network status monitoring methods (ID0153).

Korea (Republic of) (ID0188) proposed to adapt the VQEG's objective perceptual video quality measurement methods, including full-reference (FR), reduced-reference (RR), and no-reference (NR), into IPTV performance monitoring. Some implementation issues were addressed.

Apart from parameters suggested in the ITU-T Recommendation Y.1540 for IP Availability Performance Parameters, Huawei (ID0122) proposed additional parameters for IPTV network monitoring. It proposed that the IP layer use the bandwidth, IP layer available bandwidth, etc, together with other existing network performance parameters, such as IPTD (IP packet Transfer Delay), IPDV (IP packet Delay Variation), IPLR (IP packet Loss Ratio) etc., being used in IPTV applications.

One output liaison document, entitled "Performance Monitoring Parameters for IPTV", was produced and delivered on the third day to ITU-T SG12 for Quality of Service and Performance. This document asks comments from ITU-T SG12 on some new performance parameters proposed during the WG 2 meeting for the monitoring of IPTV services.

Four living lists were also produced for further study.

During the afternoon's plenary session on the last day, 18 liaison statements were produced, along with six meeting reports created and approved.

The next meeting of the IPTV FG will be held from 22 to 26 January 2007 in Mountain View, California, USA.

Acronyms:

ITU-T X.607: Information technology – Enhanced Communications Transport Protocol (ECTP)

Dr. Wei Li is a research engineer at the Communications Research Centre Canada (CRC). His current research interests include broadband wireless system, DTV system, broadband multimedia processing. Dr. Li is a member of IEEE and BTS.

The Regional Radiocommunications Conference 2006 (RRC-06)

By Klaus Huber, LS Telecom Ag, Germany

Background

From 15 May 2006 through 16 July 2006, the Regional Radiocommunications Conference (RRC-06) took place at the ITU in Geneva. This was the second session of the conference, of which the first session had taken place from 10 May 2004 through 28 May 2004, also in Geneva.

The geographic scope of the RRC-06 conference comprises about 120 countries: Europe, Africa, Arabic countries and the former Soviet Union States, or more precisely "ITU Region 1 excluding Mongolia but including Iran from ITU Region 3". Only a few representatives from these countries had not been able to attend the conference. On the last day of the conference, signatures for the Final Acts had been deposited by 101 countries.

Conference Objective

The conference objective was to establish a frequency plan and develop coordination procedures for digital broadcasting. Digital broadcasting in this context includes DVB-T and T-DAB for which protection ratios and protected field strengths are given in the Appendix of the Final Acts. The understanding of many administrations was that this allows for the related systems DVB-H and T-DMB to be introduced using essentially the same parameters as for DVB-T (ETSI EN.300 744) respectively T-DAB (ETSI EN.300 401 which is "Eureka 147"-DAB).

The new Plan which is contained in the annex of the Final Acts serves as a successor to the Stockholm 1961 Plan (ST61) in the European Broadcasting Area and the Geneva 1989 Plan (GE89) for African and adjacent areas. In fact, there were simultaneously a few sessions held by the ST61 and GE89 countries in which those Plans were formally abrogated as the new Plan replaces the old ones. In effect, three broadcast conferences were taking place during May/June 2006 in Geneva.

Scope

The ST61 and GE89 plans remain valid in band I, a frequency range that is outside the scope of the RRC. The plan entries of the ST61 and GE89

Plans which fall within the scope of the RRC-06 have been incorporated as the Analog GE06 Plan. The new Agreement covers the frequency range from 174 to 230 MHz (band III) and 474 to 860 MHz (band IV/V). The plan provides a transition period during which the Analog Plan entries still will have their protection. A controversial issue was to decide on when the transition period should end. In the Final Acts, the Plan specifies 17 June 2015 for both the VHF and UHF bands. However, there is a footnote for 21 countries - most of them from Africa - which for them states 17 June, 2020 for the VHF transition period to end. In Europe many countries intend to complete the transition some years earlier than 2015.

Channel raster on VHF

Several countries (France, Ireland, Baltic States and numerous other East European Countries) decided to change to 7 MHz channels from 8 MHz channels in the VHF band III for the digital plan while retaining their traditional channel raster for analog transmissions. The channel raster on UHF is 8 MHz in Band IV/V and applies throughout the RRC planning area. The same Multiplex can be used for 1:1 transmission on both VHF and UHF only if both channels have the same bandwidth.

The reason to change to a 7 MHz raster in the VHF band is to allow harmonization with adjacent countries and provide a better match to the channel raster of T-DAB, which is fixed and best adapted to the 7 MHz raster VHF TV channels. Having eight instead of seven channels on VHF might have also played a role.

On VHF, the channels are shared between DVB-T and T-DAB. There is no exclusive use of channels for either of them. Allocation of channels may be decided on a national basis, but there is no RRC-wide rule on it. Even if such a division is made on a national basis, there will be a sharing with transmissions of the other system from neighboring countries.

The complexity of the planning was impressive. There was not only co-channel DVB-T or T-DAB interference, but there was the option for each administration to have also their analog TV and other primary services in the respective TV bands to be taken into account in the planning process. Consideration of the analog assignments was dropped during the RRC-06 and a complementary analysis was undertaken to study the effect.

On VHF, the different channel rasters did add even more complexity since it was necessary to consider a large number of protection ratios for overlapping channels. Since no protection for analog TV services was applied in the planning process, the plan positions could be occupied by their digital counterparts. “In the planning process” does not exclude the protection of the analog transmissions during the transition period.

Assignments and Allotments

The digital Plan consists of two main entry types which are assignments and allotments. An assignment is a plan position designed for a transmitter, while an allotment is to be seen in conjunction with an area (“sub-allotment”, of which there can be several, up to nine). Within an allotment area, the same channel may be used everywhere, given that certain field strength conditions outside the area are not exceeded. This arrangement offers a more flexible planning approach and applies especially for single frequency networks (SFNs), which are possible with OFDM systems such as DVB-T and T-DAB.

Some countries followed exclusively allotment planning while some have followed exclusively assignments as plan positions. Many countries have both allotments and assignments in the Plan.

The first planning case of allotments for digital terrestrial broadcasting had been established in the Wiesbaden 1995 Agreement between CEPT countries (the European telecommunications administrations), which was purely allotment planning for T-DAB.

As source of interference coming from an allotment, not a single transmitter position is taken, but a “reference network” is assumed, which is virtually shifted along the allotment contour. To adapt for different extensions and powers of such networks, four types are specified for DVB-T and two types for T-DAB. This situation also reflects different reception cases which the planning targets for fixed rooftop antennas, portable outdoor reception, portable indoor reception and mobile reception.

Planning Iterations

During the planning process, the countries submitted their requirements and, at that stage, the requested channel could still be given as a “range” of channels (such as “UHF” or “21-36, 38-60” etc.). The creation of the Plan included the optimization task to check compatibility and - where a “range” of channels was given - assign channels in a way to find an optimum of requirements fulfillment.

From a mathematical point of view this is an NP-complete task, so the computational effort rises faster than the polynomial and brute-force methods are no longer possible. During the conference, such computations took place over the weekends consisting of four iterations. In between, the administrations could alter their requirements after negotiations with neighbors and to facilitate planning. They produced machine-readable “administrational declarations”, to supersede the results of the compatibility calculations at the ITU and declare compatibility of certain requirements of a neighboring country with its own requirements. The two men with experience in such computational tasks from conferences before were Ken Hunt and Terence O'Leary of the European Broadcasting Union (EBU), of which Mr. Hunt was

on the compatibility calculation side and Mr. O'Leary provided the optimization part. They belonged to the "core conference processing unit" (CCPU), in which mainly ITU staff was working in the processing - weekdays and weekends and at critical times both day and night.

To achieve the most efficient "number crunching", CPU time on the "GRID" was granted by CERN, world's largest nuclear research institution, also located in Geneva (and known to many as "the place the WWW was invented"). "On the GRID" means a subset of the European EGEE project was to conduct distributed computing with participating sites in Italy, Spain, Germany, Poland and Russia.

The final result is that now there are more than 70,000 digital plan positions (assignments + allotments). The printed form of the Plan for digital broadcasting has more than 2000 pages.

Organization of Conference Work

Negotiations between countries could not take place in plenary sessions. To reduce complexity and enable parallel work, the planning area had been sub-divided into "CNGs" (coordination and negotiation groups). There were five CNGs, two less than initially intended, but due to limitations of rooms and availability of ITU staff, additional groups could not be accommodated. The CNGs were sub-divided into sub-CNGs, for example the European CNG1 was sub-divided into six regional sub-CNGs.

The CNGs reported to Committee 4, which covered "Planning". The two committees with the most engineering background were Committee 4 (Planning) and Committee 5 (Regulatory) with its workgroup 5B with responsibility for the Technical Annex to the Plan. Committee 4 was chaired by Mr. Daniel Sauvet-Goichon of TDF, France, and Committee 5 by Mr. Slimane Djematene of Algeria. The conference chairman was Mr. Kavouss Arasteh of Iran.

The Fruit of Years of Work

The work did not begin with the first day of the RRC-06 conference, but the final Plan reflects the success of years of work. Two years before had been the first session of the conference, the RRC-04, which convened three weeks in Geneva. Resolutions and a report of the RRC-04, about 350 pages, had been forwarded to the RRC-06. The framework for the planning methods had been described therein. Even the RRC-04 had not been the starting point. After ITU Council Resolution 1185 had called for such a conference for digital broadcasting, a Task Group 6/8 was established under ITU-R Study Group 6, which had six meetings in Geneva and prepared a report which served as an important input document for the RRC-04.

Between RRC-04 and RRC-06, during the "intercessional period", groups were created by the RRC-04 to work on planning and regulatory matters. Test runs with the compatibility calculation and optimization part of the software, mainly provided by the EBU, have taken place with real input data provided by the administrations, so that the first iteration during the RRC-06 was not the first run and some experience, both on the processing side and on the side of the countries submitting data could be gained before the conference.

The Final Acts of the RRC-06 are now available through the ITU Bookstore in English, French, Russian, Arabic and Spanish.

About the Author

Klaus Huber (Member, IEEE and BTS) received his diploma in physics from Freiburg University and worked subsequently in the frequency planning department of SWF, public radio and TV broadcaster in Baden-Baden. After serving as a project manager for a handheld differential GPS device at GEOsat, Mülheim an der Ruhr, he joined L&S Hochfrequenztechnik GmbH in Lichtenau in 1998, which later went public and is now LS telcom AG. His field of work is in broadcast planning and coordination software. Mr. Huber is a member of DPG (Deutsche Physikalische Gesellschaft) and VDI (Verband Deutscher Ingenieure). He frequently attends workgroups at ITU-R in Geneva for the sector member LS telcom.

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BTS Senior Administrator has new addition to her family!

April Monroe and her first family addition, Holly Monroe.

The IEEE Broadcast Technology Society extends its heartiest congratulations to April and Blair Monroe on the addition of their new baby, Holly Blair Monroe, born on 31 August 2006. Holly, Mother and Father are all doing fine. April is currently on maternity leave caring for Holly. The BTS deeply appreciates the hard work and dedication April has provided to the wide range of BT Society operations, conferences and publications activities which she provided as IEEE BTS Senior Administrator. We all wish April and Blair much happiness and joy, as they care for Holly.

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