LCD TV Association

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“LCD TV Matters”

Volume 1, Issue 4

"A Great TV in Every Room"

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Chairman's Corner: From tsunamis to salmon…

by Bruce Berkoff

This issue of our LCD TV Association newsletter has me reflecting upon our industry's incredible growth, how far we have come, yet how long the path ahead still remains. We have gone from incredibly expensive (almost $4000) 30-inch LCD TVs with relatively poor image quality just a few years ago to outstanding 42-inch models from many brands well below $1000! All the specs, both true and imagined by marketers, have improved, as has real image quality and product value. We even have a fair amount of content in true HD resolutions, and finally over 100 million TVs around which can display them!

Yet, massive change is still in the works, and most homes have yet to get their first "flat TV". In the USA, we have a midnight February 17, 2009 "analog broadcasting shut off" looming ahead of us, creating both opportunity and confusion, with the former involving $40 coupons (which expire!) for every household for converter boxes if you need them (see https://www.dtv2009.gov/ for details). Many people see this as a chance to upgrade to a new flat TV (which it is), yet many more do not really understand what this means, or can, to them (or to their parents, if like me, you are the one they call with all their CE related queries).

I am reminded of the time in December 2004 when we decided to visit Krabi, Thailand during the holiday season, only to experience the tsunami that remains a vivid memory of the Earth's inherent power and mankind's relative absence of insight into key facets of the world around us, and how exposed our society can be.

On the left, we see the waters of the tsunami flowing into our hotel ½-km from the beach; thankfully we were three levels up. The center image shows the aftermath of debris on the beach – a peaceful and beautiful scene. On the right, we see the scenic beauty of a sunset the day after the tsunami on Thailand's west coast.

As for the display industry, besides a tsunami of products and brands, we face an increasing number of meetings and conferences to help us make sense of it all, and hopefully grow various ecosystems in a positive manner for all concerned.

We include what we believe to be the most comprehensive display industry calendar in the business right here in the back of our LCD TV Association newsletter (so if you know of a relevant conference and you do not see it here, email markfihn@vvm.com and let us know)!

We are proud to help sponsor some of the more unique conferences where we feel we and our members can add value, such as DisplaySearch's upcoming **TV Supply Chain Conference**, June 5-6, 2008 in San Diego,

California, where I will also be a speaker. This conference "brings together the entire TV supply chain, including retailers, TV brands, panel suppliers, TV electronics suppliers, other component suppliers and financial analysts, offering a venue to discuss the TV supply chain trends, including efficiency improvements, best-known-methods to increase margins, opportunity for profits and future outlook" (see: http://www.displaysearch.com/tvsupply). Another conference that is new this year is DisplaySearch's, **Flat Panel Digital Signage Conference** in Chicago, Illinois, on May 28, 2008. This one is "dedicated to the growing use of flat panel displays (FPDs) in out-of-home (OOH) environments", and will provide a one-of-a-kind venue for the entire ecosystem of digital signage-related companies to learn about the latest industry trends and an opportunity to establish key strategic alliances that are crucial to fostering and nurturing growth in this segment (see: http://www.displaysearch.com/digitalsignage08).

I have often felt that the big LCD TV screens next huge market could be in public displays, and as you know, the advent of huge new 52-inch touch screens (like LG Display showed off at CES'08) made a true believer out of me.

The world of Tom Cruise's movie "Minority Report" could actually begin to take shape around us today (as we unfortunately see every night in the US on CNN as they use a big touch screen to go over presidential election votes ad infinitum).

But will being awash in LCD TVs make a better world (I hope so) or will being flooded with conferences make for better business practices in the display industry? While I also hope so, something inside makes me think twice, much as I did on the beach in Thailand. We must try and learn from all events, good and bad, to help give them more meaning, and to avoid repeats where possible. My grandmother always said that "a smart person learns from their mistakes, but a wise person learns from the mistake of others", so I guess I have been around a lot of opportunity for "wisdom" in the display industry in the past. I expect more "learning" from SID this year as well. I am also reminded, however, of a speech I gave at the UC Berkeley Haas School of Business on the LCD industry a few years back, where I introduced them to "Berkoff's Law", which basically says, "Science always loses to engineering, which always loses to economics, which in turn always loses to politics". Again, not something all humans should be proud of, but something we should be aware of in order to not make those mistakes which we can avoid. I have seen countless companies, large and small ignore these basic rules in the display industry, at their shareholders peril.

Of course, hindsight is always 20/20, but it is amazing how much of the future can be predicted, yet is still ignored (or worse, argued about). People began commercializing early in LCD technology in the 70's around when they also started predicting global warming on a massive scale, yet we all seem very surprised today to have multi-billion-dollar LCD fabs all around us and a warming trend coming on globally. I have been going up to Alaska with my wife to fish at my in-laws house for way over a decade every July, and it sure does seem warmer than it used to!

Ziggy, Irene, Kodiak, and Bruce on a sunny- and warm-afternoon on the Kenai, about to see some "expert" Alaskan fishermen do their thing – the bears love this time of year!

In any event, 2008 is going to be a memorable year for sure: from the recession the USA is certainly already in, to the election cycle that has barely begun but already seems way too long, to the Beijing Olympics and digital TV transitions around the world getting closer, as well as the ramping of many Gen 7 and Gen 8 class fabs but yet we are still seeing some shortages so far. It will surely be a year of surprises, as there may be many things to not be surprised about too: notably the year where LCD TVs blow through the 100 million unit sales/year mark easily, getting better and "greener" and less expensive all the time.

The LCD TV Association is also proud to continue to grow this year, in new dimensions and with new members, some of which will be announced very soon (look for our Green TV logo program press release later this week or next and our new member release before SID). We are excited by the many changes in the world around us, and our relentless optimism knows that mankind will always thrive and excel if given the chance. We shall overcome

any technical challenges that lie in front of us today, whether it be related to products, the economy, or the growing awareness of the need to focus on renewable energy and to make all devices and processes more energy efficient. Much of this progress will begin in this difficult, but memorable year. Good luck to all of you going to SID, and a hearty BEST of luck to all of you going to, competing in, or buying (or selling) a new LCD TV around, the Beijing Olympics in China. What a great year this will turn out to be!"

"On the left we see a moose and her calf, enjoying the Alaskan summer, and on the right a big fish from an inlet nearby, so far undisturbed by the warmer climate."

Warmest regards,

Bruce Berkoff, Chairman, bruce@lcdtvassociation.org
LCD TV Association
"A Great TV in Every Room"

Mr. Berkoff is the Chairman of the LCD TV Association, a global not-for-profit marketing trade association dedicated to "informing, promoting, improving and connecting" the entire LCD TV supply chain and their related companies, to help promote "a great LCD TV in every room in the house!" For over 6 years, residing in Seoul Korea, Mr. Berkoff was also the executive vice president of marketing and chief marketing officer (CMO) for LG.Philips LCD. He has also been the CEO of a fables semi start-up in the video processing space and general manager of Philips Flat Display Systems software and electronics business unit. Prior executive positions also include UMAX Computer Corporation, Radius, SuperMac Technologies and ZD Labs. Mr. Berkoff is a speaker and author in the display and electronics industry. He has display related patents both granted and pending in the US and China. He holds an undergraduate degree in physics from Princeton and a graduate degree in biophysics from the University of California Berkeley. Mr. Berkoff currently sits on the boards of five publicly traded companies: LG Display (LGD), InFocus Corporation (INFS), Syntax-Brillian Corporation (BRLC), Tvia, Inc. (TVIA) and Uni-Pixel, Inc. (UNXL), and is known for his many visionary talks at display and technology related conferences around the globe.

LCD TV News

compiled by Veritas et Visus

3D@Home Consortium launched with industry support

The US Display Consortium (USDC) and Insight Media have officially announced the formation of the 3D@Home Consortium, a non-profit alliance of high-tech industry leaders mobilizing to provide consumers with quality, yet affordable in-home 3D entertainment. The 22 international founding members of the Consortium were revealed at an opening meeting during the NAB conference and include board level members Philips and Samsung, leadership level member Walt Disney Studios Home Entertainment, and 19 other members including Thomson, IMAX, TDVision, 3DIcon, Corning, Planar Systems, QPC Laser, SeeReal, 3ality Digital, DDD, In-Three, Quantum Data, Sensio, Fraunhofer Institute for Telecommunications-HHI, Sim2, Setred, Universal Studios Home Entertainment, Holografika and Volfoni.

> "This strong international group of founding companies is a testament to the wide spread interest and possibilities in stereoscopic 3D home entertainment," noted USDC CEO Michael Ciesinski. "We expect many more to join in the coming months with our efforts to help speed adoption of 3D in the home to begin immediately."

At the consortium's first informational meeting at the Sahara Hotel in Las Vegas, Insight Media, USDC and several founding members, provided more details about the consortium's charter and direction. The 3D@Home Consortium has been formed to accommodate the desire within the 3D industry to speed the commercialization of 3D home entertainment, while delivering the best possible 3D viewing experience to a worldwide audience of consumers. To achieve this objective, the group is focused on three primary short-term goals: creating and publishing useful technical roadmaps; developing educational materials for consumer and retail channels; and facilitating the development of industry standards and their dissemination. Driven by the success of 3D in digital cinema, an entire new ecosystem is forming to develop the hardware, software, content and delivery mechanisms to bring 3D entertainment into the home. This will include 3D gaming, sports, movies and other entertainment. "In 2008, millions of TVs, capable of showing stereoscopic 3D content, will be purchased by consumers," noted Insight Media President, Chris Chinnock. "The value of DLP, PDP and LCD TVs sold in 2008 that are capable of showing HD-quality stereoscopic 3D content is expected to exceed $2 billion dollars, making this market large enough to attract the interest and attention of many players." More details about the steering teams, membership packages and proposed organizational structure can be found at http://www.3DatHome.org

Sony and Samsung agree on additional S-LCD 8th generation fab

Samsung Electronics and Sony announced in late April that they have signed a contract to establish an additional 8th generation amorphous TFT-LCD manufacturing line through their joint venture, S-LCD Corporation. S-LCD, established in April 2004, started operating its 7th generation line in April 2005 and its first 8th generation line in August 2007 to manufacture and supply TFT-LCD panels for Samsung and Sony. To meet the increase in world demand for LCD televisions, Samsung and Sony had agreed to expand the capacity of the 8th generation line. Total investment for the 8-2 line will be approximately 1.8 trillion KRW (approximately $1.9 billion or 200 billion JPY), to be invested by S-LCD. The 8-2 line is to be built in the Tangjeong Complex, and production is targeted to start in the second quarter of 2009. Production capacity for the new line is expected to be 60,000 sheets per month initially (substrate glass input basis). The size of substrate glass from this line will be 2,200 x 2,500mm. http://www.samsung.com

Microsoft claims Vista "Ultimate PC" as the ultimate home theater controller

Microsoft introduced a new website showcasing the unique ways in which a PC running Vista Ultimate can be incorporated into a home theater system to expand functionality and improve overall performance for users. Aimed at enthusiasts, http://www.ultimatePC.com includes a variety of Vista Ultimate-based home theater setup ideas and tips. The site also includes information on maximizing Vista Ultimate PCs for video gaming, photography, home office applications and others.

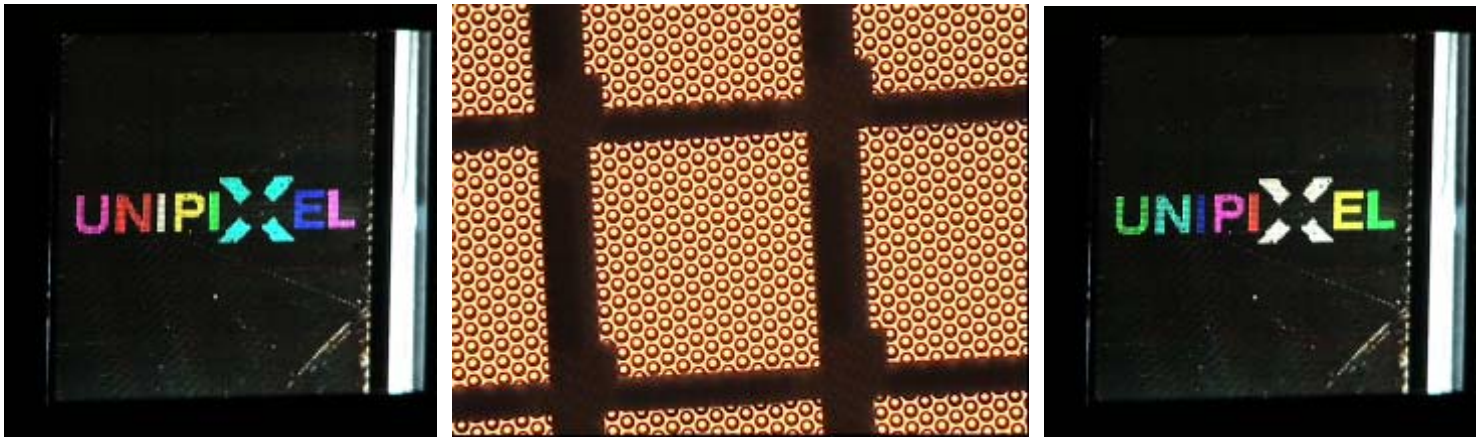
HP adds media center extender capability to Internet-connected TV

HP announced it is the first company to release Microsoft's Media Center Extender capability to an Internet-connected TV. With the capability, people using HP MediaSmart TVs not only get access to content from the Internet but they also can enjoy their own digital content from home PCs on their TV. Extender for Windows Media Center enables MediaSmart TV owners using PCs with Windows Vista Home Premium or Ultimate to shift content from the PC to the TV. The capability will be included on all new HP MediaSmart TVs and provided automatically to owners of second-generation MediaSmart TVs. Extender for Windows Media Center also will be included in HP's upcoming digital media receiver -– the MediaSmart Connect –- which is planned to be released later this year. http://www.hp.com.

UniPixel takes TMOS systems to new levels with prototype assembly

Uni-Pixel Displays announced the successful assembly of a series of prototype devices. Working with the MiPlaza Open Innovation Center in Eindhoven, UniPixel has begun assembling units to demonstrate various implementations of its Time Multiplexed Optical Shutter (TMOS) systems. The first of these systems are now being demonstrated along with results of testing on the systems. The images below show a first test prototype that incorporates UniPixel's Opcuity Active Layer film. The Opcuity Active Layer has UniPixel's proprietary micro optic structures combined with a patterned conductor implementation. The prototypes demonstrate the micro optic structures coupling light from the light guide generating a variety of output colors from the edge mounted RGB LEDs. UniPixel has also assembled prototype devices integrating the thin film transistor (TFT) backplanes provided by Philips Research Labs' Eindhoven fab. These systems have performed within the expected target ranges to include pixel activation and operation at less than 10V, and membrane speeds of less than 10 microseconds supporting full motion video capability. UniPixel is currently iterating forward on additional prototype system builds that integrate advancing subsystem implementations. In addition to including the latest Opcuity films to demonstrate the optical performance, improved light injection systems and electronic control algorithms are being integrated with these next iterations as well.

UniPixel expects to demonstrate a complete set of prototype units with the enhanced subsystem designs at the SID conference in May. These prototypes will include direct drive segment and dot matrix units was well as TFT-based prototypes demonstrating full motion video. http://www.unipixel.com



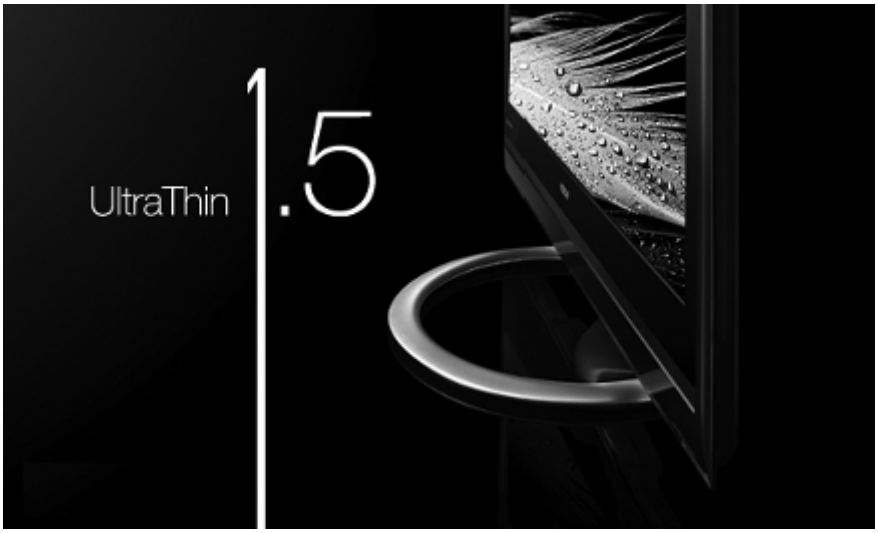
The multi-colored "UniPixel" images are screen shots of the first TMOS systems. The photo in the center is a micrograph of a TFT backplane with UniPixel's Opcuity Active Layer film, which couples light from the light guide into a variety of output colors from edge-mounted RGB LEDs.

Wal-Mart names VIZIO as Supplier of the Year

VIZIO and Wal-Mart announced in March that VIZIO had won top honors in Wal-Mart's Electronics Supplier of the Year Award for 2007. Wal-Mart added VIZIO and other select brands to its array of HDTV offerings in May 2007. During the eight months of 2007 that VIZIO was on the shelves at Wal-Mart, most of its models were among the top selling flat panel HDTVs at the retailer. http://www.vizio.com

Hitachi launches "1.5" marketing campaign

Hitachi recently kicked off its "Thin Is In Motion" marketing campaign with two promotional elements: a mobile truck tour and a hands-on experience program. Hitachi has partnered with several high-end locations for product placements of its new 1.5 family of HDTVs. Called 1.5 due to their ultra-thin 1.5-inch depth, Hitachi's displays were introduced at CES and have generated widespread consumer interest. The locations in which the new displays will be spotlighted include hotels and department stores around the US. Available this spring, the new 1.5 ultra thin displays from Hitachi will be available in 32, 37, and 42-inch sizes with a 47-inch model available this fall. http://www.hitachi.us/tv



Philips licenses North American TV business to Funai

In early April Royal Philips Electronics and Funai Electric announced a brand licensing agreement that gives Funai responsibility for the sourcing, distribution, marketing, and sales of all Philips' consumer television activities in the United States and Canada. Beginning September 1, Philips will receive royalty payments in exchange for Funai's right to exclusively use the Philips and Magnavox brand names for its consumer television offerings in North America. Philips will no longer manufacturer or distribute Philips-branded TVs. In addition to off-loading its TV business, Philips also announced that it will continue to take steps to improve the financial performance of its television operations, "by further optimizing its existing global supply base and focusing its TV business on its strongest markets, especially in Europe and in key emerging countries". The company did not elaborate on the plans. http://www.philips.com

Syntax-Brillian and Compal form HDTV partnership

Syntax-Brillian Corporation, makers of Olevia brand HDTVs, formed a strategic contract manufacturing partnership with Compal Electronics. Under the terms of the agreement, Compal will immediately begin manufacturing an initial order for 300,000 Olevia LCD HDTVs at its two-million square foot production facilities in Kunshan, China. In addition to providing assembly, testing and quality control services, Compal's procurement team will be responsible for sourcing and securing the LCD panels used to produce Olevia LCD HDTVs, the companies said in a joint statement today. According to Syntax-Brillian, the company will continue to partner with Taiwan Kolin to leverage its substantial network of suppliers to assist Compal in acquiring all other key components used to manufacture Olevia LCD HDTVs. DigiMedia Technology Company, Ltd., a subsidiary of Taiwan Kolin and co-developer with Syntax-Brillian of Olevia LCD HDTVs' patented technology, will expand their responsibilities to support Compal with engineering support and manufacturing continuity. http:/www.olevia.com

CEA reports that consumers will sell, donate, or recycle analog TVs

Questions of what will happen to millions of analog TVs following next year's transition to DTV have been answered with news that is also good for the environment, according to a new study released by the Consumer Electronics Association. According to the CEA study "Trends in Consumer Electronics Afterlife", households receiving broadcast signals only over-the-air (OTA) expect to remove fewer than 15 million televisions from their homes through 2010, 95% of which will be sold, donated or recycled. Most OTA-only households expect to buy a digital converter box (48%) and continue using the same TV. Recycling is an increasingly common way to dispose of unused TVs. In fact, according to the survey, consumers report recycling nearly 30% more TVs in 2007 than in 2005. Among those consumers that did report throwing away a TV in the last year, 42% reported that they weren't aware of recycling programs for electronics. http://www.mygreenelectronics.org

Corning opens LCD glass plant in China

In late March, Corning hosted a grand opening ceremony for the company's LCD glass substrate manufacturing facility in China. The plant, located in the Beijing Economic Technological Development Area, is the company's first TFT-LCD glass production facility on the China mainland. The opening continues Corning's trend of entering an LCD-producing region as local market demand expands. Corning currently has LCD glass facilities in the US, Japan, Korea and Taiwan. Previously, Corning stated that it expects global demand for liquid crystal display glass to grow 25% to 30% in 2008, representing an increase of more than 450 million square feet of glass to about 2.2 billion square feet by year-end. While much of that growth is driven by the demand for LCD televisions, smaller applications like LCD monitors, notebooks, and portable devices are also strong factors in overall glass demand. http://www.corning.com

LG Electronics introduces "Scarlet" series of LCD TVs

On April 29 LG Electronics unveiled the "Scarlet" series, a stylish new line of "Full HD" 1080p LCDs. The global campaign included advertising, public relations, and viral components to bring Scarlet to life. The integrated marketing campaign rolled out to more than 27 countries worldwide over the last four months and will continue through July. Key elements of the campaign included a series of broadcast, print, outdoor and online activities all featuring "Scarlet, The Hit New TV Series", with famed-director David Nutter and up-and-coming actress Natassia Malthe as the stars of the campaign. The campaign also incorporated a variety of Red Carpet and celebrity appearances, and targeted promotional activities leading up to the reveal which took place on April 28 in Los Angeles. The "Scarlet" persona was slowly seeded throughout the community via traditional public relations and social networking, with sneak previews of the TV show's trailer "leaking" on the Internet ahead of schedule to drive interest around "Scarlet". The global campaign took the form of a TV show trailer featuring a central character, "Scarlet", who can play romance, action, period-drama, sci-fi, or thriller but who also has a secret. Built around the concept that "Scarlet" would be a new hit TV series, LG Electronics first engaged well-known television director David Nutter, famous for directing some of the biggest TV shows including The Sopranos, The West Wing, and Entourage. The director found his ideal "Scarlet" in actress Natassia Malthe with whom he has worked on other projects. Malthe embodied the role of "Scarlet" for the entire six-month campaign. In her role, she appeared at Red Carpet events around the world including the BAFTA's in London, Oscar's weekend in Los Angeles, film premieres, and fashion shows. The broadcast spots, filmed on location in Bangkok, included 91 different scenes in order for the commercials to appear as a trailer for a TV series. The spots appeared on cable and network television stations the week of April 14. http://www.lgusa.com

The Scarlet HDTV LCD series ranges from 32 to 52 inches. The line features versatile design and technological innovations, including 1.8-inch thin models (42 and 47-inch), unique red-color accents, and an invisible speaker design.

Westinghouse launches "Flexible Lifestyle" 16.0-inch HDTV

Westinghouse Digital recently released its seemingly double-jointed PT-16H610S HDTV. The company dubs the TV a Flexible Lifestyle Display, and is built around a 16.0-inch LCD capable of reproducing HD content in 720p (1366 by 768 pixel) resolution. The TV's mounting and adjustability options live up to its namesake, as it can be hung upside down as on a kitchen cabinet, or mounted on a wall, thanks to dual hinges and an image that rotates by 180 degrees. The 16:9 aspect ratio TV can accept a 1080p input via an HDMI or component cables, and has a built-in ATSC/NTSC/ClearQAM tuner. Instead of buttons, the TV itself features a touch keypad. When not in use, the 16H610S folds flat. The device is priced at about $300. http://www.westinghousedigital.com

Informa Telecoms & Media says HD will reach 44 million homes globally by end of 2008

According to London-based Informa Telecoms & Media, HD television in one form or another will be seen in 44 million homes around the world by the end of 2008, with HD homes rising to nearly 180 million globally by 2012. If accurate, those are not highly impressive numbers; currently there are nearly 114 million TV homes in the United States alone. According to the researchers, only about 4% of worldwide households will "actively watch HD programming" by the end of the year—up from 2% at the end of 2007. Informa analysts say that HD uptake has been highest in North America, partly because of lower-priced equipment and a greater amount of content, but also because the picture and audio quality of standard definition programming is relatively poor in the US. By 2012, Informa expects to see 179 million "active HD homes", which it said would be about 16% of all TV households worldwide. http://www.informatm.com

Frank N. Magid Associates predicts US HD penetration has hit 25%

An estimated 5.5 million American households bought HD television sets (for the first time) in the crucial selling period from the early holiday season of 2007 in November to just before the Super Bowl. According to a survey by Frank N. Magid Associates, about 25% of America's nearly 114 million households now have at least one HD set – a 5% jump from just last September. And in another finding that will now begin to be a factor in gauging HD's growth, approximately 3 million US homes added a second HD monitor in the same winter timeframe. Magid estimates that just less than 10 million US households now have at least two HD sets each. Still, a rather sizeable minority of HD set owners are not watching HD broadcasts. Magid said about 30% of HD households are neither subscribing to HD channels via cable or DBS, nor pulling HD signals in via antenna. Reasons cited for not paying extra for HD tiers includes the fees, as well as a lack of HD channels from which to choose. http://www.magid.com

austriamicrosystems develops 16-channel LED driver for LED displays

austriamicrosystems expanded its LED driver portfolio with the AS1112, a full color LED driver ideally suited for full color applications such as LED video displays, LCD TV backlighting, indoor/outdoor full-color LED displays and large-size stadium displays. The AS1112 driver offers an integrated PWM of 12-bit with 4,096 grayscale steps per color, reaching up to 68 billion colors with RGB. Additionally, the integrated 6-bit dot-correction allows adjusting the output current in 64 steps compensating for LED luminous mismatch. With an accuracy of +/-4.5% between channels and ICs plus the dot-correction the AS1112 improves the picture quality of LED displays since variations of intensity between LEDs and LED modules completely disappear. Huge volumes of LEDs are required for high quality LED displays such as big stadium displays, commercially used indoor and outdoor displays and displays for public transportation. These top quality displays offer high color depth and brightness, high frame rates and excellent contrast ratio in order to be used even in bright sunlight. Additionally, LED error detection is a very important factor in order to optimize maintenance cost and to guarantee high picture quality. austriamicrosystems' AS1112 full color LED driver is designed for video displays with fast video action, such as in stadium and sporting event applications, as it provides a very fast refresh rate capability at 30MHz data transfer rate with no delay. Furthermore, AS1112 can be used in LCD TV backlighting where a dynamic dot-correction scheme is required to generate "tunable" white light. http://www.austriamicrosystems.com

Analogix unveils industry's lowest power HDMI transmitter technology

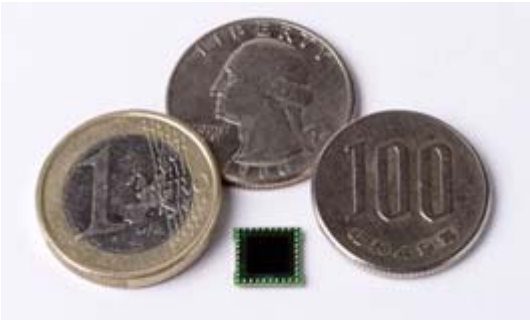
Analogix Semiconductor, Inc., a world leader in high performance analog and mixed-signal semiconductors and IP solutions, unveiled details of the industry's lowest power HDMI transmitter. The "Cool HD" technology consumes less than 50mw while supporting resolutions up to 720p and 1080i, and utilizes zero power at 480p resolution. Once released, the new CoolHD power-optimized HDMI transmitter technology will be offered in sub 0.18µm CMOS process and available in either BGA or TQFP packages. The Cool HD ultra low and zero power HDMI transmitters are designed specifically to deliver high performance to the growing small form factor ultra mobile personal computing (UMPC) market and high performance portable media player (PMP's) as well as devices as camcorders, digital cameras, and mobile phones. The Cool HD transmitter will support HDMI specification v1.2 and also feature a high-bandwidth digital content protection (HDCP) engine and keys that enable the secure distribution of content between HDMI-enabled devices. http://www.analogix.com.

Discretix, VisualOn and Axel Technologies offer joint mobile TV solution

Three prominent names in the mobile handset software space — embedded security solutions leader Discretix, multimedia application provider VisualOn, and mobile TV middleware developer Axel Technologies, have partnered to provide a pre-integrated mobile TV solution for handset OEMs. The DVB-H-based solution, which supports both the OMA BCAST Smartcard and DRM Security Profiles, delivers an ultra-reliable, out of the box strategy for the "next big thing" in cell phones: digital television. The partnership announced at Mobile World Congress 2008 in Barcelona, gives handset OEMs and service providers a new and practical alternative for rolling out mobile TV. The solution combines VisualOn's Mobile TV Player, Axel Technologies' Salmonstream Mobile DVB-H middleware stack and Discretix' Multi-Scheme Mobile TV security client. The OMA BCAST Smartcard Profile protects Mobile TV services via the use of a Subscriber Identity Module (SIM) card. Both the Smartcard and DRM Profiles ensure that commercial broadcast content can be protected and tracked when transmitted over wireless networks. In addition to supporting DVB-H, VisualOn's Mobile TV multimedia player allows T-DMB, DVB-T and ISDB-T with PVR services. Using an MPEG-2 stream multiplexer, VisualOn Mobile TV's H.264 software codec enables users to experience "iPod quality" TV on a variety of handset devices. http://www.visualon.com http://www.axel.fi http://www.discretix.com

Imagination Technologies and Sharp demonstrate multi-standard mobile TV module

Imagination Technologies, a leader in system-on-chip intellectual property demonstrated Sharp Corporation's new advanced multi-standard, mobile TV module that incorporates Imagination's mobile TV IP. Sharp has developed the VA3B5EZ915, the world's first dual-mode tuner module supporting both DVB-H and T-DMB terrestrial mobile digital broadcast reception. The receiver is highly integrated, featuring a high performance RF tuner LSI from Sharp, combined with baseband SoC also from Sharp that incorporates Imagination's ENSIGMA UCC multi-standard demodulator technology and META MTX embedded 32-bit processor. The receiver module containing both the baseband receiver and RF tuner has extremely low power consumption of around 43mW for DVB-H reception. Its impressive compact and low-profile package is just 8.0x8.0x1.25mm. http://www.sharp-world.com



Gefen's newest solutions engineered to support the expanded HDMI v1.3 format

The Gefen development includes a 1:5 Splitter for HDMI v1.3, and a 1:10 HDMI v1.3 distribution amplifier. The Gefen 1:5 Splitter for HDMI v1.3 accepts one audio/video input, such as a DVD player or set top box, and transmits the same signal to five displays. The 1:10 HDMI v1.3 distribution amplifier transmits one HDMI source to ten displays. Both units can accommodate larger distributions when "daisy chained" with another splitter. For optimal and consistent results, the source and destination displays' resolutions should match. All high definition resolutions are supported from 480p up to 1080p. Both solutions enable a clean, simultaneous distribution of one high definition audio/video signal to multiple HDMI displays. The instant delivery of HDCP-compliant video to several displays is desired in entertainment venues, public spaces, clubs, restaurants and event facilities offering a cutting-edge delivery of HDTV. The expanded HDMI v1.3 format allows for optional color and audio refinements along with an increased bandwidth. http://www.gefen.com/dealers/worldmap.jsp

Silicon Laboratories introduces industry's smallest multi-standard digital video demodulator

Silicon Laboratories announced the Si2161 and Si2165 digital video demodulators, the smallest, lowest power and highest performance demodulator solutions to support DVB-T, DVB-C and fixed reception DVB-H in a single chip. This represents the first in a new family of mixed-signal demodulators, tuners and receivers Silicon Laboratories is developing for digital and hybrid analog/digital fixed television equipment worldwide. The new Si2161/2165 demodulators are ideal for equipment receiving digital terrestrial and/or cable services including integrated digital televisions (iDTV), Free-to-Air (FtA) or pay-TV set-top box receivers, PC-TV add-on cards and DVD/HDD personal video recorders. Historically, equipment makers have had to provide multiple front ends for hybrid equipment that supports DVB-T as well as DVB-C. The new Silicon Laboratories demodulators support DVB-T, DVB-C and DVB-H for fixed reception in a single device, enabling equipment makers to simplify their design and reduce their cost by pairing their tuner solution with Silicon Labs' single-chip, multi-standard demodulators. Both the Si2161 and Si2165 products operate natively in DVB-T mode, the most widely deployed terrestrial broadcast standard in the world including Europe, Taiwan and Australia. The Si2165 adds the DVB-C demodulator mode used for unscrambled and pay-TV cable services. http://www.silabs.com

PacketVideo mobile broadcast receiver delivers new TV services to existing handsets

Eliminating a major obstacle to launching mobile broadcast services, PacketVideo (PV) demonstrated its patented new pocketable mobile broadcast receiver that turns WiFi-enabled phones and personal media players into mobile TVs. PV's mobile receiver device decodes a digital TV signal and repurposes it for use on the phone, sending it via a wireless signal, such as WiFi, to a playback device. The receiver uses specific, patented protocols to ensure optimum rendering of the TV signal on the playback device, and provides secure access to premium channels. This allows mobile subscribers to upgrade to advanced mobile TV services without changing their current handset. The mobile broadcast receiver will be available in versions for all major mobile broadcast standards, including TDtv, DVB-H and MediaFLO as well as for WiMAX. The device can also be customized with the operator's badge or branding for the retail market. The mobile broadcast receiver is compatible with many industry-leading phones including the Nokia N-series, Apple iPhone and HTC Smartphone devices. http://www.pv.com

PacketVideo introduced its new pocketable mobile broadcast receiver at Mobile World Congress. The matchbox-sized device allows mobile subscribers to upgrade to advanced mobile TV services without changing their current handset.

Saigant Technologies demonstrates Difron to stream Internet content to the TV

Saigant Technologies recently demonstrated Difron at the Digital Living Room Conference in San Francisco. Difron is an appliance that seamlessly delivers Internet media direct to the television. Difron is the next level in media entertainment that gives the consumers the choice of watching any television station anywhere in the world that is on the Difron network. With Difron, media outlets, independent movie and television producers can stream direct to an ad-supported free TV, or offer a pay-per-view event to a global audience. The Difron appliance requires a simple connection to the TV, just like a cable box. There are no content downloads involved, so content owners will never have to worry about piracy. http://www.difron.com

Parade Technologies showcases DisplayPort receiver on Konka LCD TV

Parade Technologies announced that its innovative DisplayPort receiver DP601 is powering the industry's first DisplayPort technology-enabled 42-inch LCD TV from Konka of China. This innovative LCD TV also features two ports of HDMI inputs and MEMC technology. A live demo of this TV set was performed at IDF 2008 Shanghai from April 2-3. "The PC industry is quickly adopting DisplayPort technology," said Mr. Lin Gaike, president of R&D Center and vice president of TV Product Division, The Konka Group. "Konka is proud to take a leadership position by introducing the industry's first DisplayPort technology-enabled LCD TV. By supporting high resolution digital display with digital audio and content protection, DisplayPort technology is ideal for bridging the display from PCs to TVs." http://www.paradetech.com/

Samsung's single-chip channel decoder supports global TV standards for cell phones

Samsung Electronics unveiled the S3C4F60, a 65nm single-chip mobile TV system-on-chip (SoC) which combines a channel decoder with an RF chip. Samsung's new S3C4F60 supports all worldwide TV standards with respect to frequency range and channel bandwidth, giving consumers the ability to enjoy real-time news, sports, weather forecasts, and live entertainment anywhere. Samsung's new receiver chip supports six different mobile TV standards and complies with all related specifications of DVB-H/T (ETSI EN 300 744, EN 302 304, EN 301 192 and MBRAI); ISDB-T (ARIB-B29/ B31 1/ 3-Seg); T-DMB [Korean T-DMB, DAB (Eureka-147)]; and DAB/ DAB-IP standards. The integrated built-in multi-band RF tuner supports VHF III (174-240 MHz), UHF (470-862 MHz), and L-bands (1350-1750 MHz). Samsung's S3C4F60 also offers a significant boost in mobile performance. By achieving 180Hz Doppler frequency performance at DVB-H 16 QAM, 8 K, 2/3 CR, and 1/4 GI, mobile TV products using the S3C4F60 can achieve perfect reception of digital TV signals, even inside high-speed trains like the TGV, ICE, or Shinkansen traveling at speeds of up to 300km/h. Fabricated in Samsung's advanced 65nm process and housed in a tiny 5x5mm wafer level chip scale package (WL-CSP) to minimize the footprint, Samsung's new S3C4F60 integrates into a single chip a low noise amplifier (LNA), embedded SRAM, analog-to-digital converter (ADC), PLL, CPU (ARM 7) and a low drop-out, thereby greatly reducing the number of external components needed. http://www.samsung.com

Newport Media demonstrates world's first mobile TV system-on-chip (SOC) for MediaFLO

Newport Media, a fabless semiconductor company supplying products to the mobile broadcast media market, announced sample availability of the world's first complete single-chip solution for the MediaFLO mobile broadcast platform. The NMI700 FLO mobile digital TV receiver integrates a RF tuner, demodulator, MAC and all required memory into a single monolithic CMOS device that will enable designers of cellular handsets, and non-connected portable devices to deliver the smallest, power-efficient and cost effective products available. "Sample availability of the NMI700 SOC represents a significant technical and business milestone for Newport Media," said Mohy Abdelgany, president and chief executive officer for Newport Media. "Newport Media clearly stands alone in its ability to offer best in class SOC solutions for all major commercial mobile TV standards. The addition of a pin-for-pin compatible MediaFLO SOC to our portfolio of DVB-T/H and ISDB-T SOCs will significantly enhance our ability to be the supplier of choice for mobile TV system silicon solutions." Key features of the NMI700 solution include up to 120dB of variable gain and greater than 50dB of adjacent channel selectivity. The device consumes only 20mW of power, yet still combines an extremely low 3.0dB noise figure with a very high +5dBm IP3. The monolithic chip includes a dual-band VHF and UHF radio, a FLO demodulator, MAC, plus all necessary memory in a very small footprint. No other external memory, baluns or loop filters are required to create a complete solution with a very low bill of materials. http://www.newportmediainc.com

HP, DreamWorks preview breakthrough in color display technology

HP and DreamWorks Animation previewed a display technology that helps solve a longstanding obstacle for digital content creators: affordable and consistent color accuracy between devices. The result of a collaboration between the two companies, the HP DreamColor Technology computer display provides accurate, predictable color and a simple color management process to assure vision-to-production color consistency in a wide-screen LCD. The display generates the industry's first combination of true 30-bit color – enabling a range of 1 billion colors – in an LED-backlit LCD at a fraction of the cost of most high-end, studio-quality LCD displays. Designed for the broadcast, film/video post-production, animation and graphic arts fields, the HP DreamColor Technology display offers richer color and darker blacks than previously available through LCD display technology. The display will include factory presets for all color ranges specified by the NTSC, SMPTE, sRGB, Rec. 709, Adobe RGB and DCI standards. The demonstration marks the first public preview of a display technology developed under the HP DreamColor Technology initiative, a two-year collaboration between HP and DreamWorks Animation. The HP DreamColor Technology family is a series of displays, printers and technologies that work together to provide accurate, predictable color that makes it easy to manage the proper configuration of color across devices and achieve standout results, every time. http://www.hp.com

Tokyo Electron Device announces de-interlace LSI achieves non-blurred video images

Tokyo Electron Device Limited (TED) has launched sales of "TE3450RPF", an LSI that de-interlaces video images (NTSC/PAL signals) generated by general-purpose analog cameras into progressive images that are suitable for display devices such as LCDs. TE3450RPF is a product that implements the existing de-interlace IP "TD-DeINTip" on an LSI, and enables easier adoption in small lots. Reference designs will also be provided to customers in support of speeding up their product development. Video display devices such as surveillance camera systems that are rapidly becoming widespread in recent years require digitization as well as higher resolution and faster frame rates. However, when general-purpose analog camera generated NTSC/PAL signals are compressed into JPEG format images using simple field insertion methods, the images become blurred (combing noises occur) due to time differences between the odd and even fields, thus making it impossible to clearly distinguish the contents of surveillance video images, such as car license plate numbers. TE3450RPF implements features including the "Motion Adaptive De-Interlace" feature that automatically detects and corrects areas that are in motion by referencing the motions of previous and next fields using a proprietary still/motion distinguishing function, and the "Correct Diagonal Line Function" that enables reproduction of smooth diagonal lines in images, altogether realizing smooth high-quality progressive images. http://www.teldevice.co.jp/

[Simple Field Insertion]

[When TE3450RPF is used]

US IPTV revenues to hit $13.7 billion in 2012 according to Strategy Analytics

IPTV service revenues will approach $14 billion in 2012, growing from $694 million in 2007, according to "US IPTV Forecast and Outlook," a report just released by Strategy Analytics. Although there are numerous IPTV providers of all shapes and sizes in the US, the landscape is largely dominated by the two incumbents: AT&T and Verizon, each of which has a different approach in terms of technology and investment. "2007 was a watershed year for IPTV in the US market," said Ben Piper, Director of the Strategy Analytics Broadband Network Strategies service. "The two major US players reached critical mass in terms of subscriptions. The onus is now on service providers to quantify and articulate the benefits of IPTV against "traditional" Pay TV media, such as cable and satellite." ARPU is expected to remain relatively stable throughout the forecast period, and service growth will come largely from an increased number of IPTV-passed homes, and higher take-up rates. "Our models suggest that IPTV will make impressive headway in the next several years, both in terms of overall homes passed and service revenues," said David Mercer, Vice-President of the Strategy Analytics Digital Consumer Practice. "Service providers have only a limited number 'levers' to pull, and should try to think holistically in terms of an overall customer experience." In addition to providing an outlook of the current United States IPTV market, this report forecasts homes passed, homes connected and service revenues in the market through 2012. In addition, it identifies key imperatives for service providers to compete effectively in a highly penetrated Pay-TV environment. http://www.strategyanalytics.com

Sony develops new close proximity wireless transfer technology "TransferJet"

Sony announced "TransferJet", a new close proximity wireless transfer technology enabling the high speed transfer of large data files (photos, HD images, etc.) between electronic devices such as mobile phones, digital cameras, digital video cameras, computers and TVs. Using this technology, data can be sent at speeds of 560Mbps. TransferJet is an extremely simple wireless technology which eliminates the need for complex setup and operation. For example, just touching a TV with a digital camera enables photos to be instantaneously displayed on the TV screen. Alternatively, downloaded music content can be easily enjoyed by touching a mobile phone to a portable audio player. TransferJet can be used as a universal interface among a wide variety of consumer electronics devices.

NXP launches world's smallest single-chip triple-mode PCTV solution

In a move to bring a high-quality anytime, anywhere TV viewing experience to ultra-mobile computers, NXP Semiconductors, the independent semiconductor company founded by Philips, launched the world's smallest single-chip PCTV solution – SAA7231 – that supports worldwide broadcast standards. Packaged in half the size of a minicard, NXP's latest innovation is 40% power-efficient, saves OEMs up to 15% of total BOM (bill-of-materials) cost, and speeds up time-to-market to under one month. NXP's SAA7231 is ideally suited for TV cards in current and future flavors of Microsoft Media Centre Edition (MCE) PCs, with support for analog, DVB-T and DVB-S broadcasts as well as an integrated MCE-compliant IR controller for a full-function remote control. A state-of-the-art video processing engine decodes the analog AV stream for features such as PVR and time shifting, while adaptive 2D noise reduction improves picture quality. http://www.nxp.com/

NTT Electronics develops HD H.264/MPEG-2 multi-format encoder and decoder modules

NTT Electronics has developed HDTV encoder and decoder modules (the SC50KE and the SC50KD, respectively) that are dually compatible with H.2641 and MPEG-2. These products maintain the high-quality video of the VASA2 single-chip coding integrated circuit (IC). The VASA IC has brought superior results for the use of MPEG-2 in HDTV environments within the broadcasting industry and includes various peripherals and high-speed memory, and features on the newly-developed H.264/MPEG-2 encoder IC, SARAENC, and the decoder IC, SARADEC.3 The products are comprised of simple devices, but realize professional high-quality images. Due to the demand for high-quality video and more efficient and compact devices, there has been a need for H.264, 4:2:2 chroma-compatible codec products in the broadcasting equipment industry. Additionally, the need to support the currently predominant MPEG-2 format still exists. NTT Electronics' products are the only multi-format encoder and decoder modules in the world that meet these market needs. The modules also feature the encoder and decoder ICs as well as the necessary peripherals and high-speed memory. http://www.nel-world.com

ABI Research predicts big uptake of home theater PC systems

ABI Research says there will be some 25 million home theater PC systems installed worldwide by 2013, with adoption boosted by the media applications in Microsoft's Vista software, a new study revealed. The study says that HTPCs, or media centers, will retain a key role in the connected living room of the future despite the multitude of non-PC devices now available for at-home entertainment. It says that PCs will play an ever-increasing role in the management, distribution and playback of multimedia content in the home, with both network-connected PC media servers and in-living room PCs growing in adoption over time. An HTPC is a convergence device that is connected to a television or a television-sized computer display for use as a music, video player, personal computer, TV receiver and digital video recorder. Microsoft's bundling of the Media Center application with Vista will help solidify the role of the PC in future living rooms, and clients running over home networks and extender technologies will be the early adopters, the study says. However, these efforts will take time, and there will be some bumps in the road, as shown by the fate of Intel's Viiv program. Additionally, while new broadband-based services may bypass the home PC initially, the PC model will become more inclusive in the future. There will still be a small market of home theater PC enthusiasts who buy custom-designed home theater PC systems resembling consumer audiovisual equipment, the study says. While all-in-one systems are a bit bulky today, in the future, we will see more optimized designs for converging the PC and TV.

Magnum Semiconductor announces DX8110 Professional H.264 SD/HD encoder

At the National Association of Broadcasters show, Magnum Semiconductor Corporation, a leader in video compression technology, announced the DX8110 Professional Encode solution, the first member of the company's sixth-generation DX1 family of video encoder products. The DX8110 H.264 encoder provides a scalable platform for full-featured broadcast solutions for IPTV and satellite encoder applications. "The DX8110 raises the bar for video quality and performance among H.264 devices," said Bob Saffari, vice president of marketing for set-top and broadcast products at Magnum. "Equipment makers now have a path to continuous improvements in quality and efficiency for their state-of-the-art video compression systems," he added. The DX1 family of chips is based on the Magnum Domino[X] media processor architecture, a flexible and scalable multi-core design for standard definition (SD) and high definition (HD) encoding. The DX8110 provides a rich set of pre-processing capabilities including motion-compensated temporal filtering (MCTF) and content-adaptive deblocking, resulting in superior noise reduction for crisper images. http://www.magnumsemi.com

AOptix Technologies enhances link capabilities for HD sports television production

AOptix Technologies announced recent successful Free Space Optical (FSO) lasercom link transmission tests for a national sports television network in New York and San Jose. Recent demonstrations showcased the benefit of eliminating a long fiber run to an HD camera feed above the New York skyline. The AOptix broadcast lasercom terminals were located atop the GM Building on 5th Avenue and near the production truck, 1km away in Central Park. The 2.5Gbps bi-directional link consisted of an uncompressed 1080i camera and gigabit Ethernet feeds through a single, line of site, single-mode-fiber connection. In San Jose, two additional long-distance demonstrations showcased the portability and ease of set-up for the AOptix system. TV network engineering executives were impressed when observing error-free performance at distances of 0.6km and 3.2km. Continuous un-compressed HD-SDI and SD-SDI video feeds along with gigabit Ethernet, audio, and production line comms were transmitted over DWDM lasercom. Terminals were placed on the rooftops and inside a mobile van on a parking garage roof. To achieve stability and link quality over the air, the LCT-5 uses the AOptix Adaptive Optics technology to compensate for atmospheric distortions in real time. This revolutionary approach to FSO, minimizes the effects of atmospheric scintillation, dramatically enhancing link availability. http://www.aoptix.com

Philips develops digital watermarking integration for consumer electronics products

Philips is the first manufacturer to offer a watermarking solution in its hospitality television sets and will have it available starting in May in a full range of LCD TVs including 26-, 32-, 37-, 42- and 52-inches. Hoteliers have long enjoyed an early-release movie window that allows them to entertain their guests with box-office hits prior to release on DVD. Philips VTrack digital watermarking solution will ease concerns about piracy that have led certain content owners to withhold high-definition media from this advance window. In an effort to deter the unlawful copying of high definition movies in hotels and enable hoteliers to ensure that they remain available to their guests, Philips developed the VTrack solution. Philips hospitality products already utilize highly-effective Pro:Idiom encryption technology to secure data from the content source to the television. Philips VTrack extends anti-piracy efforts by making electronic and camcorder copies of video material traceable and thereby decreasing the risk of piracy. Philips VTrack embeds the video with an invisible watermark that identifies the time, date and location. Therefore, if a video shows up on the Internet or on pirated DVDs, content owners and law enforcement agencies can use the VTrack watermark data to determine where and when it was recorded. http://www.philips.com/ci

A-VSB Initiative demonstrates the first end-to-end ATSC-compatible mobile broadcast TV platform

The A-VSB Initiative, whose members include Samsung Electronics, MobiTV, Nokia Siemens Networks, Rohde & Schwarz and SES AMERICOM's IP-PRIME, announced a live demonstration of an end-to-end broadcast mobile TV platform at NAB. The platform has been proposed to the Advanced Television Systems Committee (ATSC) as an open ATSC Mobile/Handheld (ATSC-M/H) standard. It includes the A-VSB physical layer and global standard OMA BCAST service layer for mobile broadcasting, showing live local and national content as well as interactivity. The live demonstration at NAB 2008 used existing Las Vegas transmission infrastructure owned by the Sinclair Broadcasting Group (station KVMY) and Telemundo (station KBLR). In addition to live local and national programming, interactivity and electronic service guide functionality were also demonstrated for the first time in an ATSC-compatible mobile broadcast system. http://www.mobitv.com http://www.nokiasiemensnetworks.com http://www.ses-americom.com http://www.samsung.com

Gefen extends HDMI reach using CAT-5 cable

Connectivity solutions provider Gefen announced the arrival of two new distribution solutions for digital high definition sources and displays using the HDMI format. Available in distributions to four and eight displays, both rack mountable units also enable the extension of HDMI audio and video beyond its specified limits over industry-standard CAT-5 cable. The 1:4 and 1:8 HDMI CAT-5 distribution amplifiers include a sender unit that performs a seamless split of one HDMI input with delivery to multiple displays. Users have the option of ordering small, individual receivers for remote displays that must be placed a distance from the source. Signals can travel up to 300 feet (100m) at resolutions to 1080i, and up to 150 feet (50m) at resolutions to 1080p. Multi-channel audio is delivered alongside the video using two CAT-5 cables that connect the HDMI source (sender) to the display (receiver). Both sender and receiver units are powered to ensure a high quality HDTV signal complete with HDCP compliance at both short and long range distances. If users opt to connect their HDMI displays directly to the sender, no additional power is needed. http://www.gefen.com/kvm/product.jsp?prod_id=4719

Alliances and partnerships change LCD TV panel picture

by Paul Gagnon

Paul Gagnon is director of North American TV Research at DisplaySearch. His 10 years of retail and manufacturing experience in the consumer electronics industry adds value and insight to DisplaySearch's leading industry analysis. At DisplaySearch, Gagnon calls upon his expertise in consumer purchasing behavior to provide in-depth analysis of US sell-through trends and sales forecasting. Before joining DisplaySearch, Gagnon served as a senior marketing analyst for Hitachi America LTD's Home Electronics Division. There, his responsibilities included the development and implementation of retail sales incentives as well as the forecasting and analysis of ever-changing TV and video market trends. Gagnon has also been a member of the CEA Video Division Market Research Committee.

The TFT LCD panel industry consists of over 20 suppliers in East Asia, including Taiwan, China, Korea and Japan. The relationships between these players are quite complex and interrelated (*as shown in Figure 1 below*), sometimes as competitors and sometimes as collaborators. As the LCD market matures it becomes more challenging for so many players to survive profitably, and so we are starting to see a distinct trend towards consolidation of those makers. Primarily the collaborations are centered on panel allocation agreements or sharing of technology patents. This article will give a highlight based synopsis of these arrangements based on a study undertaken by DisplaySearch and presented in a topical report entitled “Asian LCD TV Panel Maker Alliances & Joint Ventures Analysis”

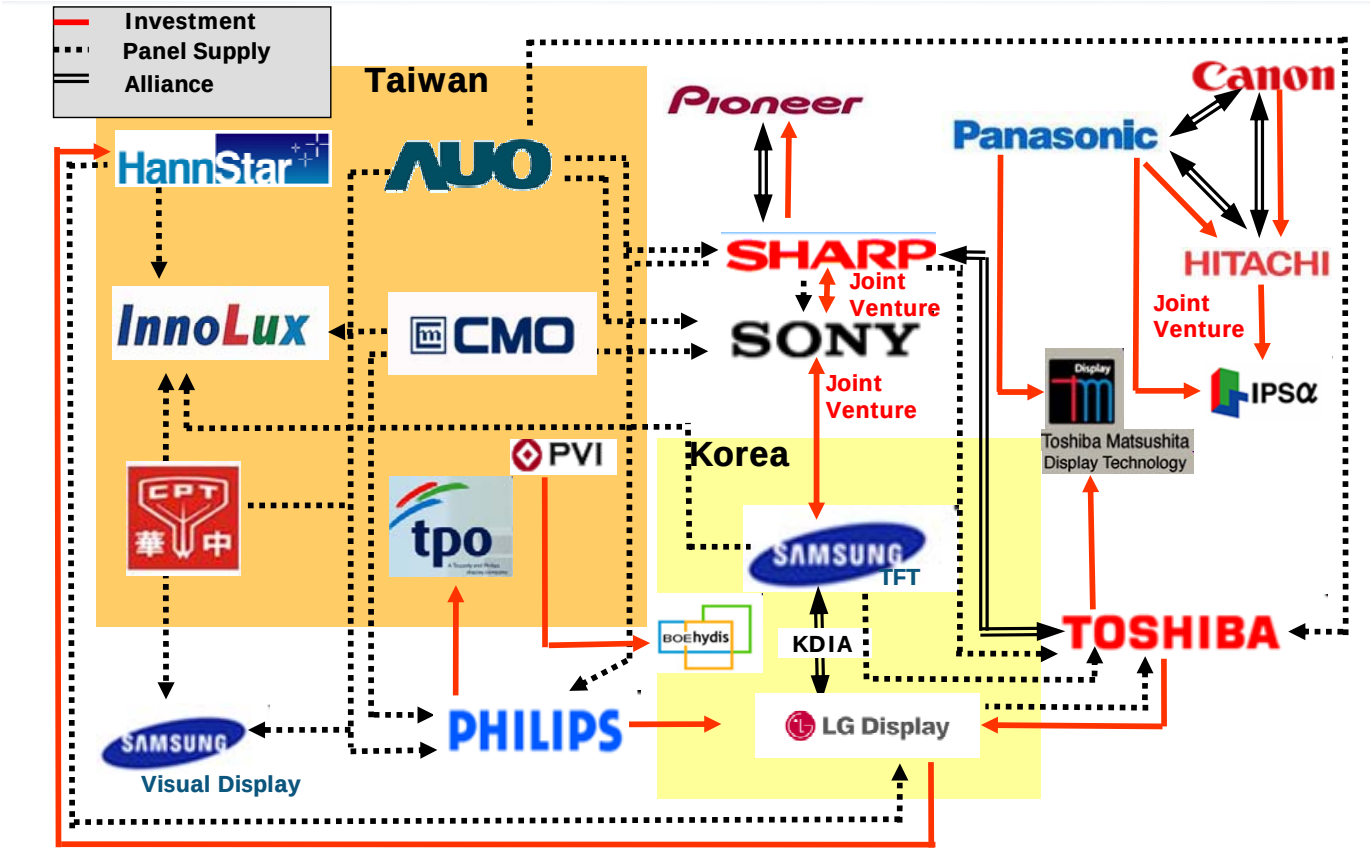


Figure 1: Asian TFT LCD Maker Relationships

Sony-Sharp G10 partnership

The biggest news of recent months has been the announcement of a joint venture between Sharp and Sony for a G10 fab, set to begin mass production in 2009. The move was somewhat surprising give the close relationship Sony maintained with Samsung for the G8 S-LCD factory that supplied to panels to both brands. In addition, the mother glass size seems to be targeted to optimize 40 and 46-inch production (Sharp sells LCD TV's at 42-inch and 46-inch) while also being able to serve up larger sizes efficiently to compete with PDP in the 50-inch and larger space. The move clearly shows Sony's influence (Sony sells 40-inch LCD TV's) though Sharp will likely be the primary capital contributor to the project.

Sony has aggressive plans for market share in 2008 and beyond, targeting 20% global LCD TV unit share, so securing reliable panel supply is critical to achieving those goals. In addition, Sharp gains a strong consumer brand as a customer, decreasing the reliance on the Sharp AQUOS TV brand as a consumer of Sharp LCD panels. It also reduces Sharp's financial burden to front the nearly $4 billion cost for the factory. However, even as collaborators in panel production, Sharp and Sony are still competitors in the TV market, just as Samsung and Sony were in the S-LCD investment. Maintaining distinctly different brand identities in the marketplace while sharing panels will be important for Sharp to avoid giving up market share to Sony for finished goods.

Sony-Samsung: still friends?

Sony and Samsung had strong cooperation for the S-LCD joint venture that concentrated on 40, 46 and 52-inch panels across G7 and G8 fabs. The partnership proved quite successful from 2005 through 2007 and both brands enjoyed market share growth. But both companies are also fierce competitors in the consumer market for TV's as they both support the same screen sizes. Sony continues to invest in the L8-1 G8 fab buy 52-inch panels, but it is unclear what level of investment Sony will make in L8-2.

Samsung has talked about G10 and G11 is rumored, but the glass size and production timing are TBD. Sony was seen as a possible co-investor, but the new partnership with Sharp for the Sakai G10 plant seems to all but eliminate that possibility, though Sony did not completely discount the possibility. Samsung would have to find a new partner or undertake a G10 venture solo.

IPS Alpha picture gets more complicated

Prior to March 2008 IPS Alpha was a three-way partnership between Hitachi Display's Ltd. (50%), Toshiba (15%) and Panasonic (30%). Canon has now entered the picture as Hitachi Display's Ltd., previously 100% owned by Hitachi, is now partially owned by Canon (24.9%) and Panasonic (24.9%) making Panasonic the largest stakeholder of IPS Alpha as Toshiba's investment is transferred to Panasonic.

Currently IPS Alpha operates the G6 LCD fab at Mobara that concentrates on 26, 32 and 37-inch with an annual capacity of 5 million 32-inch equivalent panels. There are now plans though for a new G8 fab located in Himeji that will have an annual output of 15 million 32-inch at full capacity and give Panasonic an internal supply of 40-inch+ class LCD panels, though the fab would be optimized for 32, 46 and 52-inch panels. Mass production would begin in 2010. Panasonic will continue to insist on PDP technology for 42-inch because of the investment in the Amagasaki PDP fab which will start producing panels earlier than the Himeji G8 LCD fab.

Other panel alliances-partnerships

- **KDIA (Korea Display Industry Association)** – Formed between Samsung and LG Displays under the urging of the Korean government. Technology differences (VA for Samsung and IPS for LGD) as well as fab and panel size differences will make it difficult to work closely together. Both companies have also been fierce competitors for many years, but alliances like Sony-Samsung prove that is not necessarily an insurmountable obstacle. Most significantly impacts Taiwanese panel companies who are suppliers to Samsung and LG.
- **Sharp:Pioneer and Sharp:Toshiba** – Sharp will turn into a panel supplier to both Pioneer and Toshiba, though by different means. Sharp has become a 14% investor in Pioneer and will supply sub 50" panels to Pioneer who will likely keep to PDP for 50-inch+. Both companies will also share expertise in other electronics like Blu-Ray DVD, car and audio. Sharp is also now a close partner with Toshiba supplying them with 32-inch+ panels while Toshiba supplies Sharp with semiconductors.

After a return to excellent profitability for panel suppliers, capacity is poised to expand in 2009 and beyond. Certainly panel suppliers have maintained a significant amount of supply chain power in the tight market for panels, but the balance of power could be shifting back to brands. In addition, as Sharp supplies a greater portion of panels externally, becoming more of a merchant supplier, and Panasonic builds a new G8 LCD fab, merchant suppliers like AUO, CMO and LGD could come under increasing competition in the near future. This trend warrants close observation.

To further explore the relationships mentioned above in greater depth, including fab plans and scenarios, please check out DisplaySearch's "Asian LCD TV Panel Maker Alliances & Joint Ventures Analysis" topical report.

Retail price survey of LCD TVs in Q1'08

by WitsView

WitsView is a neutral market research firm dedicated to the TFT-LCD industry, providing a full coverage of information resources and analytical research to over 1,800 companies worldwide. WitsView's service consists of all-round quantitative research, bottom-up industry analysis and insightful market viewpoints that enable clients to make prompt and convinced decision. http://www.witsview.com

According to WitsView's survey, in the 20~52-inch size group, the global average retail price dropped sequentially by 2.3%~12.9% in Q1'08, a bigger decline than the +2.9%~-4% change seen during the previous quarter. The largest drops occurred in the biggest-sized 52-inch (-12.9%) and smallest-sized 20-inch (-6.4%). It is worthy to note the recent ForEx fluctuations sharply changed the local retail price when converted in US dollars. Between Dec'07~Mar'08, the exchange rate between the English pound and US dollar was relatively stable, down by a mere 0.7%. However, the Yen, Renminbi and NTD were up by 4%~8.1% against the US dollar. By contrast, the Won sharply depreciated, dropping by 4.1%.

Region-wise, due to the US Super Bowl event, the above 42-inch was down by more than 5%. Separately, in the China market, the 26~40-inch instead increased, while in the UK market, the below 26-inch and above 47-inch saw a more than 10% decline. Meanwhile, excluding the respective 15% and 17% price decline in the 46-inch and 52-inch segments, the other sizes only slightly fell in the Taiwan market. In Japan, due to the launch of new models and changes in the exchange rate, the 32, 37, 40 and 46-inch either edged down or remained flat. Finally, in the Korea market, prices mostly trended downwards. Given the Won's huge depreciation, the retail price of the 32~52-inch slipped by roughly 10%.

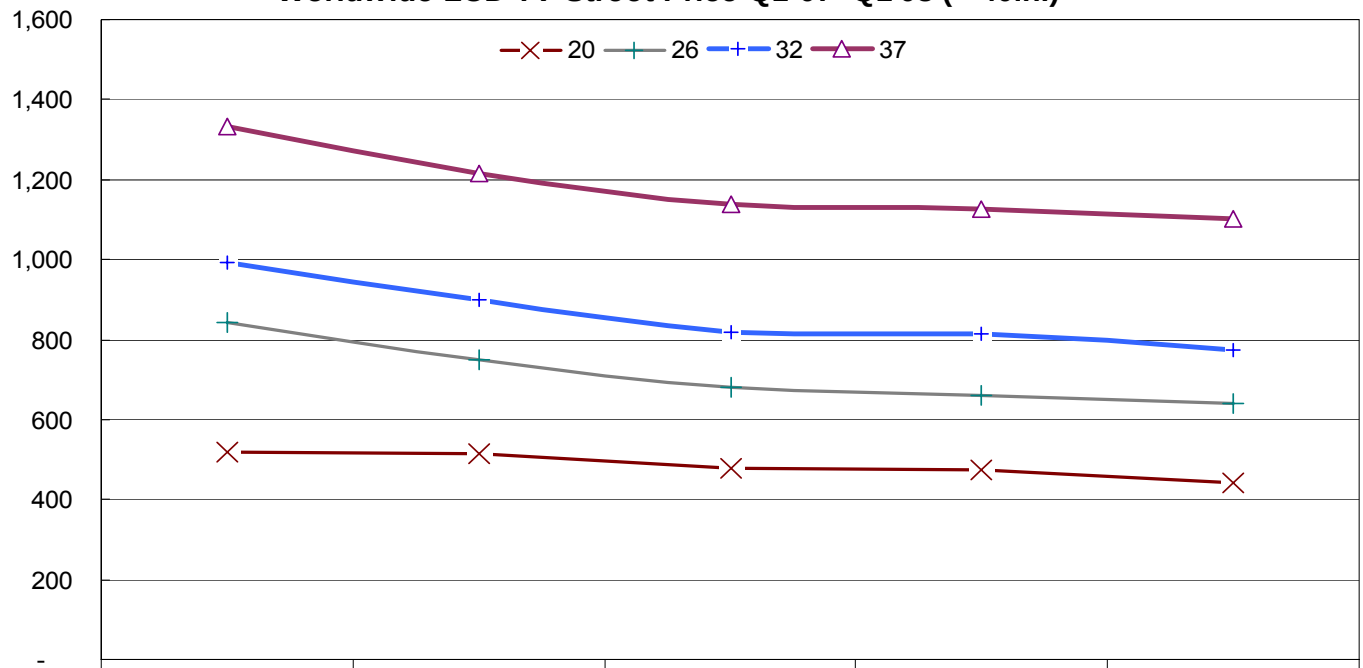
2x-inch: The average price of the 20-inch reached $442, down by 6.4% Q/Q. Excluding the 52-inch, this was the biggest decline among the various TV sizes. In the past, the 20-inch LCD TV was seen to drop by an average of 10% Y/Y. However, as the cheaper 19W and 22W LCD TVs, which employ monitor panels, become more widespread, it has started to more significantly affect the price of the 20-inch LCD TV. This is most evident in the European market. Take the UK for example. In Q1'08, the 20-inch was priced at $491, down 13% Q/Q, we the 19W and 22W LCD TV could be respectively bought for $384 and $454.

Meanwhile, the average price of the 26-inch was $641. This amounted to a 2.8% decline from the previous quarter's $660 and a Y/Y drop of 24%. The price change of the 26-inch was mostly affected by the 32-inch, where the price gap between the two ranged between $133~$150 in the past year. Beginning from 2008, the 26" started to drop below the $700 level in the UK market, as several Tier 2 brand vendors, such as JVC, Humax, Hyundai and Beko launched new models.

3x-inch: In Q1'07, the 32-inchslipped past the $1,000 for the first time. Currently, it has fallen to $774, a 4.7% Q/Q and 22% Y/Y decline. In the US market, the 32-inch was retailed at US$ 679, down by 4% Q/Q and falling below the $700 level for the first time. Meanwhile, China was the only region to see an increase (3%). Despite the increase, it continues to sell the cheapest available 32-inch LCD TVs. In 2008, several Tier 1 brand vendors started to unveil Full HD 32-inch LCD TVs. Excluding Sharp, Toshiba's RV530 and Panasonic's LZ80 and LZ85 have all started to hit the market.

The 37-inch was retailed at $1,102, down 2.3% Q/Q and 17% Y/Y. The price gap between the 37- and 32-inch was $328, roughly the same as the $341 seen during Q1'07. Among the various markets, the smallest gap was in North America ($173), while the biggest was in Korea ($604). The huge gap stemmed from the more expensive 37-inch TVs in Korea. By contrast, in the 37-inch/40-inch segment, the smallest gap occurred in Korea ($133), while the biggest was in Taiwan ($609).

Worldwide LCD TV Street Price Q1-07~Q1'08 (< 40in.)



	Q1-07	Q2	Q3	Q4	Q1'08
20	519	513	477	472	442
26	842	750	679	660	641
32	992	898	818	813	774
37	1,333	1,216	1,139	1,127	1,102

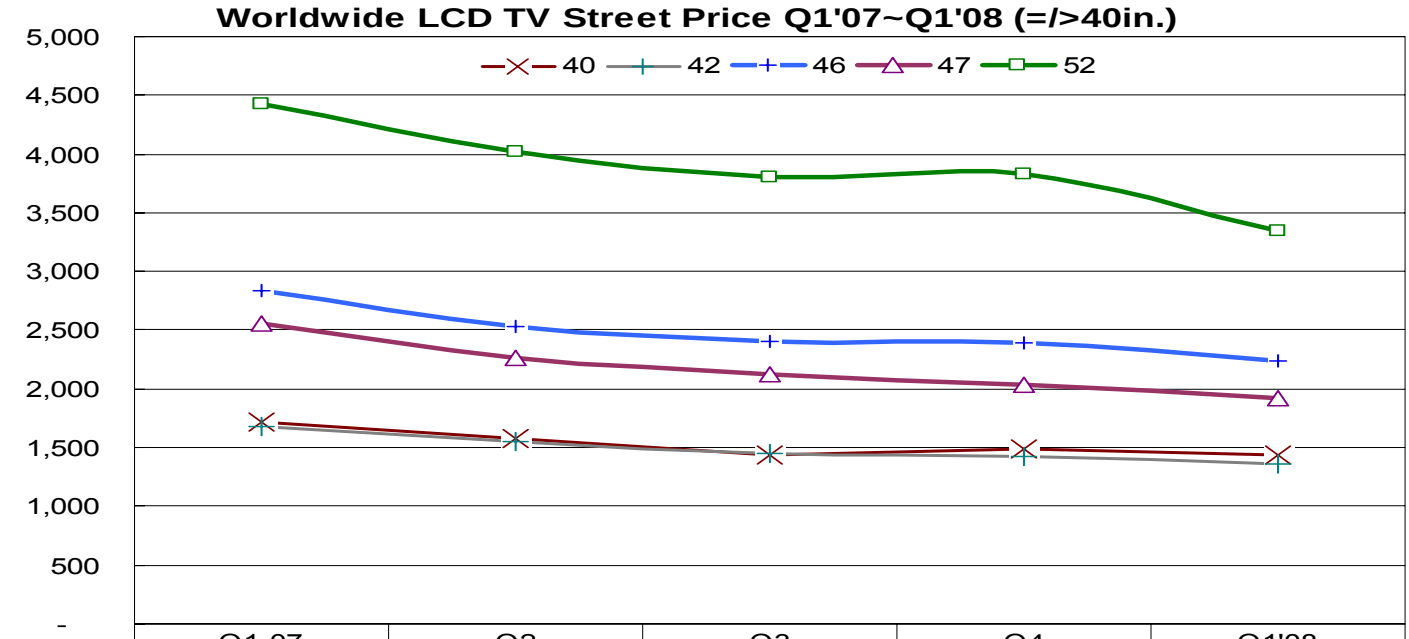
4x-inch: The average price of the 40-inch reached $1,441 in Q1'08, down 2.9% from $1,485 in Q4'07. On an annual basis, this was equivalent to a 16.4% drop, which was the smallest decline among the 40-inch and above. In China, prices stood at $1,075, far lower than the global average. Unlike other regions, where Sony and Samsung are the dominating brands, there are many budget priced 40-inch models offered by China's local brands. Separately, the 42-inch reached 1,358, down by 4.5%, which was a bigger drop than the 40-inch, resulting in the price gap between the two to reach $83. In the US market, the 42-inch could be bought for $1,084. In the next quarter, there is a chance to see the 42-inch slip past the $1,000 level in the US. China is one of the few exceptions, where the 42-inch is more expensive than the 40-inch (price gap: $144).

The average price for the 46-inch reached $2,241 in Q1'08, down by 6.2% from $2,390 in Q4'07. Korea ($2,551) and Taiwan ($2,764), which was the two more expensive regions, both witnessed a 2-digit decline, resulting in the retail price to be similar to the global average. In the US market, prices also fell by 7%. Tier 1 brands, such as Sony's XBR4/5, Toshiba's RF series, and Samsung's 71F series and Tier 2 players such as Westinghouse and Hyundai all saw an average drop of $200.

The average price of the 47-inch slipped past $2,000 to $1,924, down 5.4% from the previous quarter. Compared to the $2,500 selling price in Q1'07, the 47-inch has already fallen by 24.9% Y/Y---the biggest decline among the various sizes (even bigger than the 24.5% drop in the 52-inch segment). At the moment, the price difference between the 47-inch and 46-inch has increased to $317. By contrast, the gap was roughly $274 last year.

Philips and LG are the only two major Tier 1 players that still produce 47-inch products. If JVC also exists from the

Japan market, as reported by the news media, the 47-inch may disappear from Japan altogether. Prices of the 47-inch varied among the different regions. In the UK and US, prices fell respectively by 8% and 11.6%, while in Japan it was up by 10%. This was attributed to the launch of JVC's new 905 series and the diminishing presence of By-design, Toshiba and Sanyo's 47-inch models.



	Q1-07	Q2	Q3	Q4	Q1'08
40	1,723	1,572	1,443	1,485	1,441
42	1,675	1,549	1,453	1,423	1,358
46	2,836	2,526	2,402	2,390	2,241
47	2,562	2,260	2,118	2,033	1,924
52	4426	4017	3798	3,834	3,340

52-inch: The average price of the 52-inch reached $3,340. This was down sequentially by 12.9%; the drop was the largest among the various TV sizes. Excluding the 4% decline in the Japan market, the other regions all registered a 2 digit drop. The price gap between the 52-inch and 46-inch reached $1,099, which was much smaller compared to last year's $1,590. The average price in the US was $2,022, down 12% Q/Q. In Q1'08, Westinghouse, Olevia and Magnavox started to roll out 52-inch models. The cheapest was Olevia's 252T, available for only $1,400. Sharp's LC-52D43U was also relatively cheap, retailed at a mere $1,500. However, the resolution supports only 1366x768.

Like the US, China is considered another region, where lower-priced LCD TVs can be found. However, the 52-inch was not particularly cheaper. Available for an average of $3,064, this was similar to the retail price in the UK and Japan, but more expensive than the US's $862. In China, the price gap between the international and local brands was seen to be narrowing. In Dec'07, 52-inch prices of the international and local brands stood respectively at $4,096 and $2,705, a difference of $1,391. But just after 3 months, the price of the international brands reached $3,566 in Mar08, while the local brands remained unchanged at $2,672, resulting in the gap to narrow to $893.

LCD TV Association

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"A Great TV in Every Room"

Interview with Eddie Yeo from LG Display

Mr. Sang Deog Yeo is currently serving as executive vice president and head of LG Display's TV business unit. Previously, Mr. Yeo served as head of the monitor design team at LG Electronics. After joining LG Display in September 1999, Mr. Yeo served as head of the development center. Mr. Yeo received his Bachelor of Science degree in electronic engineering from Kyungbuk University. Mr. Yeo is well-known for his ability in predicting the LCD TV's evolution paths and understanding customer needs based on his thorough understanding of the LCD technology. He spearheaded the development of the world's largest 100-inch LCD panel and has a reputation for being an engineering marketer.

LG Display Co., Ltd is a leading manufacturer and supplier of thin-film transistor liquid crystal display (TFT-LCD) panels, OLEDs and flexible displays. The company provides TFT-LCD panels in a wide range of sizes and specifications for use in TVs, monitors, notebook PCs, and various applications. LG Display currently operates seven fabrication facilities and five back-end assembly facilities in Korea, China and Poland. The company has a total of 22,000 employees operating in ten countries around the world. Please visit http://www.lgdisplay.com for more information.

Please give us a quick overview about LGD's strategies related to the LCD TV market. LG Display plans to lead the full HD and 120Hz LCD TV market with its world-leading wide-viewing angle IPS technology. In particular, IPS technology offers the following advantages: wide viewing angle (178 degrees), fast moving picture response time (MPRT 4.6m/s), low power consumption (30% less compared to existing products) and stable picture quality (no afterimage when touched). By realizing clear and fast moving picture quality without afterimages, IPS is being hailed as the most ideal technology for the high-resolution TV era featuring full HD and 120Hz sets. LG Display possesses a full fab lineup from 2G to 8G and is therefore able to produce LCD TV panels of diverse sizes. By establishing a global production system with plants in Nanjing and Guangzhou in China and Wroclaw in Poland, LG Display is expected to have a greater advantage in targeting the global LCD TV market.

Where does LGD fit in terms of market share in the overall market for LCD TVs? LGD will retain its existing customer structure and strengthen its market dominance. We plan to maintain M/S of 2007 levels (approximately 24% by display area). Our goal is to increase the share of products in the 40-inch class.

The TV market is much more seasonal in nature than the PC market. Please describe how LGD is addressing the seasonal changes in demand for LCD TVs. Although demand for LCD TVs was sensitive to seasonal changes, the influence has been gradually decreasing since the second quarter of 2007. Since a supply shortage is actually expected from the second quarter of 2008, we believe that the overall supply-demand situation will remain tight for the year. Going forward, LGD plans to actively counter seasonal fluctuations by aggressively seeking out new customers, uncovering new demand sources for under 30-inch TVs, and manufacturing premium products such as full HD 120Hz panels.

In consideration of the increasing utilization of the family TV as a device used to play games, view photographs or home videos, browse the Internet – all things beyond the usage of watching a TV show or movie – are these new usage patterns driving different LCD design solutions? In line with such trends, LG Display is introducing high-resolution products, such as its full HD 120Hz panels, based on its IPS technology. We believe that aside from resolution, there is no real demand for new design solutions.

Do you foresee any fabs of the future that will be even larger than currently planned with "Gen 10" substrates? Basically, a TV size is determined by the consumer's home structure, price acceptance and actual utility. LGD forecasts that for now, the largest TV size will not exceed the 60~70-inch level.

Combining cost and typical viewing distance factors, what size of a TV do you think will ultimately hit the "sweet spot" for the typical living room experience? The viewing distances for CRT (4:3 aspect ratio) and LCD (16:9 aspect ratio) are calculated differently. The human viewing angle is set to wide. In other words, there

are more constraints regarding height than width. According to picture quality experts, in a living room where the distance between the sofa to TV is 1.5m, a 47~50-inch screen is an appropriate size. We expect that in the not too distant future, more families will change their living room TVs to the 47-inch class.

LCD makers have recently introduced new designs that are targeted at reducing the physical size of the LCD module, both in thickness and by shrinking the bezel area surrounding the display. It seems that at some point there are diminishing returns in finding further improvements in these physical dimensions. What do you think will be the typical edge margins and thickness specifications of large-area LCDs in the future? Thinness is more urgently needed in panels for notebooks and mobile devices rather than TVs. With a TV, reducing the thickness of the panel and shrinking the bezel area entail higher costs. Therefore, we think that the optimal design will be decided within consumers' price acceptance levels.

There has been chatter recently about shifts to aspect ratios that are wider than the current 16:9 solutions, perhaps to 2.35:1. Do you think such solutions are likely? Some products may be put out on the market, but I don't think that any will become a standard aspect. Since most peripherals are also set to an aspect ratio of 16:9, it'll be difficult for any other standardization to take place quickly. A new aspect ratio may be possible for products which are used for special purposes.

The TV market seems to be shifting rapidly to "Full HD" – 1920x1080 pixels, progressively scanned. What are the cost and performance tradeoffs for an LCD manufacturer when comparing production at 1080p versus 720p? 1080p versus 1080i? The growing consumer need for high-resolution pictures, such as HD and full HD, is also fueling a growth in the high-resolution TV market. This means that high-resolution TVs have already reached a price level that is acceptable to consumers. LGD plans to continue with its R&D and mass production to further lower prices.

Several companies have now previewed TVs at 3840x2160 and at 2560x1440 pixels. Do you think these enhanced resolutions will come to find a significant presence in the LCD TV market in the coming years? Currently, HD broadcasts are set to 1080i and 720p format. Since a scaler chip that can support resolution over 1920x1080(full HD) has yet to become popularized, it appears unlikely that super high-resolution will be used for ordinary LCD TVs. I think it'll only be used for public information displays.

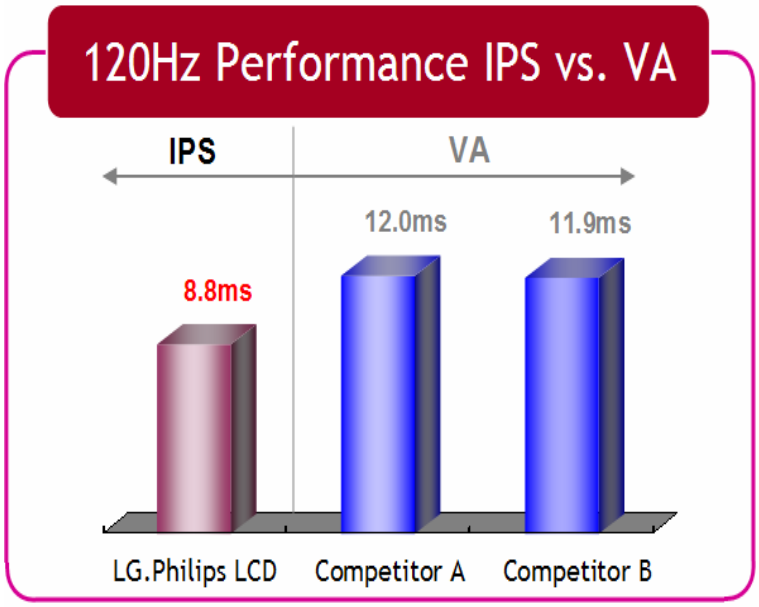
PDP seems to have some difficulties in moving to higher resolutions. Do you think LCD makers will move to resolutions beyond that of 1080p simply to out-specify the PDP manufacturers, or do you think there are some truly compelling reasons to do so in terms of the visual experience? As I said earlier, the majority of picture source, including HD broadcasts, is below 1080P. Additionally, even if you were to display the current standard of picture source like HD broadcast on a super high-resolution LCD display, it would be difficult to provide a more enhanced visual experience due to the limitations of the human eye. Therefore, for ordinary TV viewing, we believe that full HD resolution is sufficient. However, for public information displays or 3D displays, you need more than full-HD and that's why super-HD products are continuously being developed for next-generation displays.

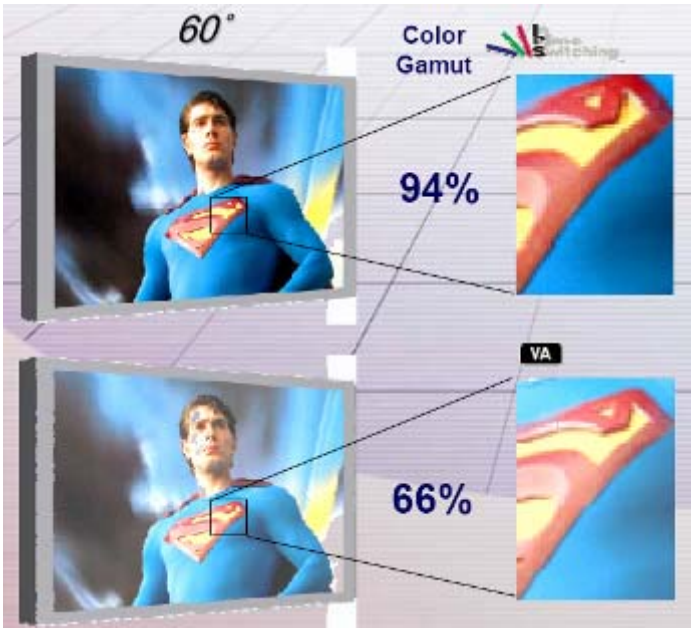
Emissive display technologies (such as CRT, PDP, and OLED) have historically claimed advantages over LCDs in terms of overall performance. Please give us your observations about such claims. CRT cannot compete with LCD in size and OLED still has many technical difficulties to resolve. Therefore, we forecast that the competition between LCD and PDP will continue for the time being. In terms of picture quality, both LCD and PDP have their strengths and weaknesses. LCD's advantages are its brightness, contrast ratio and energy consumption levels, while PDP boasts relative strengths in motion blur and viewing angle. However, motion blur and viewing angle, which had been pointed to as LCD's shortcomings, have been resolved recently with technology such as wide viewing angle technology like IPS and DFR (Double Frame Rate) technology to overcome motion blur. These new technologies have equaled or even surpassed those of PDP.

Viewing angle limitations are frequently pointed to as a limitation of LCD technology. Can you tell us how LGD's In-Plane Switching (IPS) technologies help improve viewing angles. LCD possesses structural weaknesses in the form of viewing angle limitation and left-right asymmetry. To overcome these structural

weaknesses, two types of wide-viewing angle technologies were developed: IPS mode and VA mode. In particular, contrary to VA mode which features liquid crystal moving vertically like the existing TN mode, IPS can be regarded as having structurally improved the viewing angle by changing the movement of the liquid crystal into a horizontal direction.

What are the advantages of IPS when compared to other viewing angle enhancements such as Vertical Alignment solutions? As I mentioned earlier, both IPS and VA were developed to realize wide viewing angle. However, the IPS mode improved the basic liquid crystal driving method to make it more suitable for wide viewing angle. Therefore, you can say that IPS offers superior wide viewing features than VA. In fact, if you watch a TV from the front and the side and measure the color shift and gamma shift which indicate how much colors change, IPS has a color shift of 0.018 (based on 60 degrees), while VA has 0.037. IPS has a gamma shift ratio of less than 1% (based on 60 degrees), while VA shows 40%. Looking at such data, you can see that compared to VA, IPS shows hardly any color shift between the front and side viewing angles.



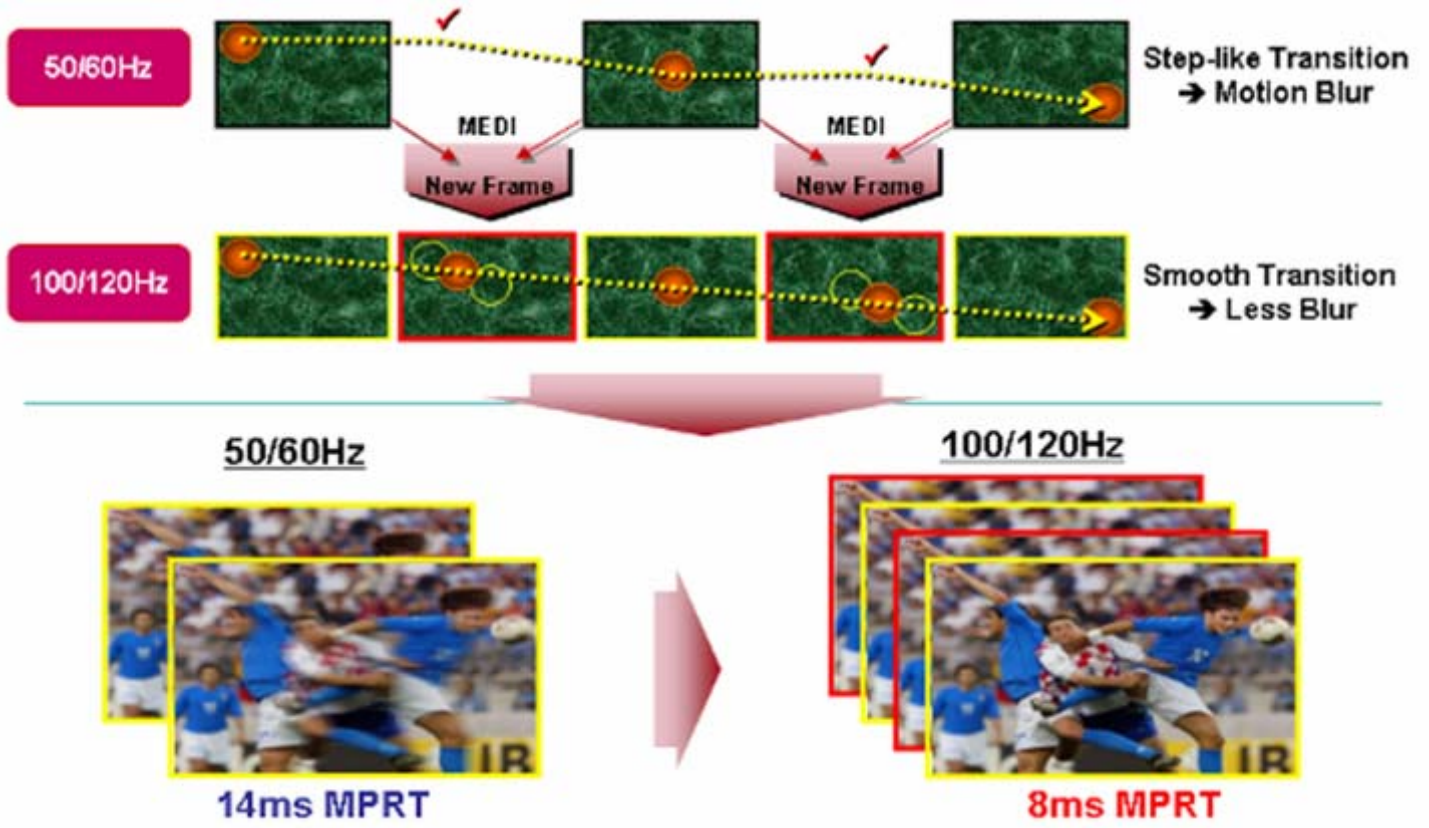


The chart on the left shows a comparison of response times achieved by LPL's panels using In Plane Switching and its competitors using Vertical Alignment. Lower times are better. The image on the right shows that LGD's IPS technology provides wider color gamut at the viewing angle as compared to Vertical Alignment.

LGD has claimed that IPS is the optimized technology for motion blur reduction. Please, explain why this is the case. For MBR (motion blur reduction), you basically need a fast response time of the liquid crystal, and high-speed/mass amounts of signals must be processed without loss within the panel. In terms of response times, VA shows major differences between dark and bright pictures, while IPS always provides fast response time regardless of the picture. Additionally, since IPS panels have a simple TFT structure compared to VA and use copper writing that offers little resistance, they boast both technical and product advantages in processing fast/large amounts of signals without data loss.

In percentage terms, what level of cost does 120Hz add over a similar 60Hz LCD TV? Although prices differ by set maker, looking at products currently sold on the market, there appears to be a price premium of about 20~30%.

Do you believe that 120Hz solutions will become dominant in the LCD TV industry? As I mentioned earlier, LCD creates a blur phenomenon according to the liquid crystal driving method. The 120Hz technology that was developed to resolve this phenomenon is likely to establish itself as the future standard of LCD TVs.



Basic concept behind LGD's 120Hz motion blur reduction technology

Already some projection TV makers have showcased 240Hz solutions. If 120Hz makes sense, is it reasonable to expect that the next step in LCD TVs is going to be a move to 240Hz? Currently several technologies are being considered and studied as the next step after 120Hz, one of which is 240Hz. Both 120Hz and 240Hz require development of a chip that can change the current broadcast form of 60Hz to 120Hz or 240Hz, along with the development of a panel for high-speed driving method. Until now, the chip solution that could change 60Hz to 120Hz did not offer sufficient availability in terms of technical or cost aspects. Particularly with 240Hz, we forecast that development of a chip solution will be even more difficult than 120Hz. This means that it will be tough to develop 240Hz as the next step after 120Hz, and it appears that grafting scanning B/L to the current 120Hz technology is the most realistic method to improving MBR (Motion Blur Reduction) for over 120Hz.

Historically, one of the limitations of IPS has been that it demanded an increase in power consumption. Is this still the case? No. LGD has continuously worked on improving the transmission rate and as a result, we are recording better results compared to VA. In particular, LGD has steadily improved power-saving technologies such as EEFL or OPC, so power consumption can no longer be regarded a limitation of IPS.

Considering the increasing concern about the environment, what sort of things has LGD down to assure its LCDs are "green"? LGD limits the use of hazardous materials and acquired RoHS certification. We are also continuously improving the transmission rate to lower power consumption. Additionally, in our new products under development, we plan to internalize an algorithm called OPS (Optimal Power Control) that can lower power consumption by using a backlight that flexibly adjusts to the input picture.

Of LGD's many technology and business development breakthroughs, tell us about the one thing that you personally are most proud to have been associated. As I mentioned earlier, the 120Hz LCD TV market is forecast to record rapid growth. IPS offers several advantages over VA regarding 120Hz and currently, we are the only LCD panel maker to possess technology to produce wiring with copper, a low-resistance substance.

Thoughts about the TV market…

by Henry Choy

Henry Choy is vice president of TV and video research at Jon Peddie Research. He is an industry veteran of 19 years with senior level positions in sales and marketing in the graphics, video, and multimedia markets since 1989. He delivered the first PC-based 3D texture mapping graphics card to Id Software in 1995. He has held various positions in engineering, ISV evangelism, business development, marketing, and sales with a number of leading companies. JPR is hosting the IDTV conference on May 14, 2008 at the Howard Plaza Hotel in Taipei, Taiwan. See http://www.jonpeddie.com/events/IDTV2008/ **for more information. It's the only conference that covers the hardware and software technologies that go inside the TV system board.**

Interactive TV conference and their future

Two weeks, two TV related conferences, 32 hours of talks and one hundred and forty speakers later, I have come to realize that we are truly at an inflection point for the future of TVs. People talk about it and try to hype the changes in different markets but I think it's real this time. The direction is not clear with everyone experimenting with ideas and so we'll see more changes to the TV in the next 10 years than since color TV was introduced in 1953 - 55 years ago.

New set top boxes and DVRs, connected TVs, user generated content, broadcaster putting content online, Internet video channels, peer to peer file downloads, new ad types, interactive platforms just to name a few will give more opportunities to new companies and models than ever before in TV land. I've thought about the information from the conference and other data points that I've complied. Here's a list of topics that directly relate with the TV market and the implications of these different factors.

Interactive TV

Being raised in the PC era, I always think about WebTV whenever I hear about interactive TV. In 1997 Microsoft paid $425M for WebTV Networks that delivered e-mail and web browsing on the TV. Microsoft hoped to dominate the living room as well but their dominance in the TV segment never occurred. Most people dismissed the idea of Web browsing on the TV because TV is a sit back and enjoy event. Just like having someone else constantly changing channel is annoying let alone watching someone else surf the internet on a TV, maybe it's OK for people living alone, but certainly not family or social events.

Fast forward time 11 years later to 2008 and it's now the CE companies' turn to get the TV's connected to the Internet. Sharp, Panasonic, Samsung and other showed networked TV's at the 2008 CES. All have a walled garden and partnerships to deliver content to the TV. These companies have also introduced Power Line adaptors to avoid the installation complexities and problems with the various flavors of 802.11. The last thing the CE companies want is for you to call them for support and eat into their razor thin margins.

Sony and Apple have an external box to deliver video. Tivo's business model continues to evolve from a DVR only device to interactive longer form ads. LG partnered with Netflix to view movies download through the Internet on a LG box. The cable and satellite companies are offering interactive electronic programming guides, video on demand, and interactive ads to name a few. Apple has raised the bar in terms of ease of functionality and user interface. The TV companies will be able to offer similar look and feel for future TV but the cable/satellite companies will have a harder time due to their installed base of current customers. Any changes to the cable or satellite interface will always result in increase in support calls.

The TV companies have a walled garden where they control the access of the data sent to their TV. Whether it's a widget or video feeds to the TV, interactivity is extremely limited and is nothing like WebTV from the late 1990's with open access to any web pages. The protected wall garden will almost certain to go to full access once the compatibilities issues are resolved. Full access and interactivity does not mean you will be able web surfing anywhere on the Internet.

If you think about interactivity today, it's actually here. It's not what was imagined with WebTV. How many times have you voted for a singing contest like American Idol? This could be either on the phone, website or SMS message to a vote on a TV contest like American Idol on FOX, Dancing with the Star on ABC or even American's Best Dance Crew on MTV. How many times have you gone to a website flashed on a TV program to get more information? How many times have you gone to a news channel site after you see a report to get more information? That's all interactive TV. Granted it's a two-screen experience but it is interactivity and they do drive you to be more engaging. Maybe we should stop calling it "Interactive TV" and instead call it "Engagement Viewing". It draws us into the viewing experience. It gives the network a chance to get you to be more involved with their brand. It gives the networks another chance at keeping your eyeballs for more ads.

The two-screen experience could actually be accepted in the living room. Younger generation is texting all the time already. It's not hard to imagine the interactivity to becoming richer on a cell phone. Better graphics, displays and touch screens could easily enable that. It could also be a remote from someone like Logitech or the remote that comes from your TV to include small breakaways modules for the family to interact with. It could even be a pointing device that will evolve around the Wii controllers today. The important point is that interactivity does not have to come directly from the TV screen.

Figure 1: First Web Page of WebTV
http://www.answers.com/topic/msn-tv?cat=technology

Peer-to-peer networks

There's a song that reminds me of the music and Hollywood's effort trying to stop downloads from the days of polyester suits and bell bottom pants. Just replace the word "music" with "music download" and sing to Village People's song "You can't stop the music."

> *You can't stop the music download, nobody can stop the music download.*
> *Take the cold from snow, tell the trees, don't grow,*
> *tell the wind, don't blow, 'cause it's easier.*
> *No, you can't stop the music download, nobody can stop the music.*
> *Take the spark from love, make the rain fall up*
> *'cause that's easier to do.*

Despite attempts to shut down websites and suing people, downloads continue and grow at a phenomenal rate. Mininova.org is a peer-to-peer site and is currently ranked fifty fourth by Alexa.com. The ranking is based on reach and page views. They were able to reach to 4B downloads within 4 years. It could reach 10 billion downloads by the end of 2008 and 100 billion by 2010. It's no wonder that film and music industry is so very concerned.

Everyone hates DRM and they are so many ways around them. The producers, actors, writer, and distributors all need to get paid for their hard work but the file sharing is just not going to stop. Embrace it and the money will come. People want the content first but people prefer to get trusted content that is high video and audio quality. That's why there are a number of uploaders that have a fan base in the P2P world. People in the P2P world know who uploads quality content.

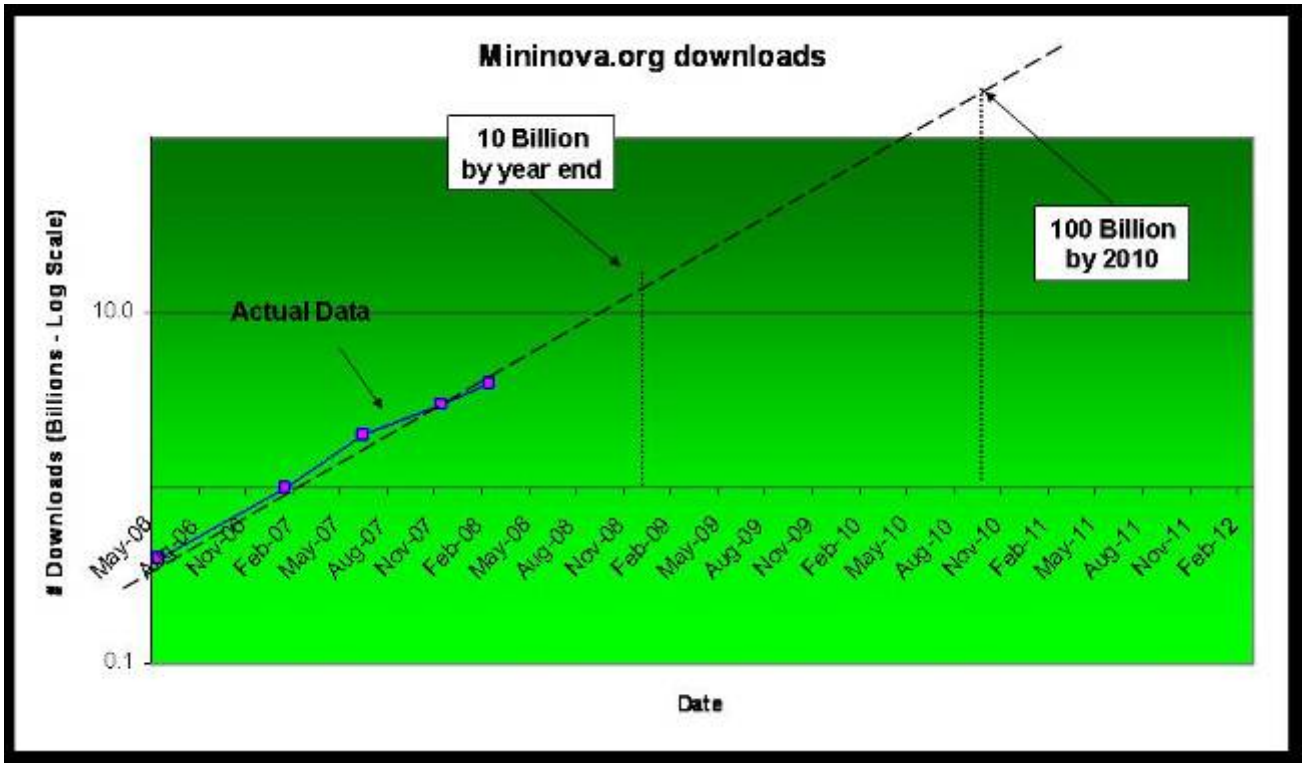


Figure 2: Mininova downloads over time

What if you could download movies from studios directly for free? Would you mind a pre-roll ad for an upcoming movie? Or how about an ad which is overlaid on the video as it's played? There would be a feedback to report the viewing back to the studios so they can justify the price of the ads to the advertisers on the file shared content. It's a win, win for all.

Consumers get an infinite DVR, the content providers get ad dollars from a carefully placed ad, and the advertisers get accurate reach data that will help them with right targeting. Win, win, win. Imagine a TV that is now connected and have USB port for a thumb drive to store downloaded video using Bittorrents. Instead of setting a recording time based on when a show is broadcasted, you set what shows and seasons you want to watch. The shows appear a few hours or days later depending on the broadband speeds and the consumer watches it at their convenience.

Multimedia at work: the IDTV conference – featured speakers

Nikhil Balram from Marvell Semiconductors is the keynote speaker at the upcoming IDTV conference to be held in Taipei, Taiwan on May 14. Balram will be speaking on the topic. "A Vision of the TV set in 2010 and beyond". Other morning speakers include Henry Choy, Jon Peddie Research, Mark Fihn, Veritas et Visus, and Jon Peddie, Jon Peddie Research. The remainder of the conference is comprised of panel sessions that will include expert commentaries in specific areas. Sessions include:

- Worldwide digital conversion: Moderator: Henry Choy, JPR
  Panelists: Keith Potter (Digital TV Labs), Wim Renirie (Micronas), John Tryhub (Fresco)
- Future challenges and architectures panel session: Moderator: Henry Choy, JPR
  Panelists: Doug Bartow (Analog Devices), Wen Li (Trident), Jo Ann Chang (NXP Semiconductors), Michael Ching (Rambus), James Goel, (Silicon Optix)
- Audio advancements and key challenges: Moderator: Jon Peddie, JPR
  David Grant (Cirrus Logic), Skip Taylor (D2Audio)
- Panel Session: Software in TV's: Moderator: Kathleen Maher, JPR
  Panelists: Gareth Vaughn (ARM), Hiten Patel (Portrait Displays), Mike Harris (AnySource Media), Jeff Allen (Rallypoint Systems)

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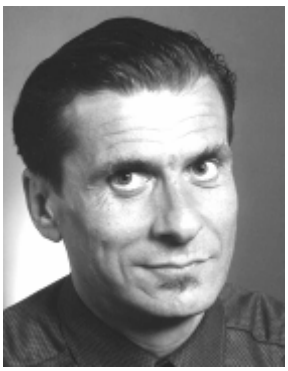
“Viewing angels”: a not so rare species…

by Michael E. Becker



Michael E. Becker is the founder and CEO of Display-Metrology & Systems (DM&S) in Karlsruhe, Germany (http://www.display-metrology.com), a company providing customer specific and off-the-shelf hard and software solutions for measurement and rating of electronic display visual performance. After completion of his PhD at the University of Karlsruhe and prior to the establishment of DM&S he worked for autronic-Melchers (1985-2001), first as section head, and from 1993 on as a managing director, developing and marketing a range of instruments for measuring LCD visual performance and LCD material and device properties and a software package for numerical modeling of LCD electro-optical performance (DIMOS). Michael has been actively contributing to a variety of international standards for electronic visual display devices (IEC TC110 and ISO TC159/SC4/WG2). In 2006 he received the IEC-1906 Award for his contributions to the IEC standardization activities. He invented a variety of German, European and international patents in the field of optical metrology instrumentation, and he has authored and co-authored numerous technical and scientific papers.

When I recently asked my favorite search engine for occurrences of the term "viewing angel" I got "about 19,200 English and German web-pages for “viewing angel” - most of them not obviously related to esoterics, but rather to the field of electronic display devices.

Contrast versus viewing direction*:* Since the early 1970s when LCDs started to move into consumer products like pocket calculators and wrist watches, there was the question on how to specify the range of viewing directions from which (among other quantities) the contrast of these device seemed to be sufficient. A first step to answering that question was the development of instruments that could provide measured data as basis for the rating of the electro-optical performance of LCDs of which the majority were operated in the reflective mode those days [1]. Since the contrast of LCDs is varying with viewing direction, the result of such evaluations was not a single number, but an array of results that needed to be understood, visualized and rated.

A convenient and intuitive way of visualization was adapted in 1979 from *conoscopy*, a technique for probing the optical properties of crystals as a function of the direction of light propagation, introduced into the field of liquid crystals by Maugin in the year 1911. In the *directions image* that is formed in the back focal plane of a polarizing microscope objective lens in the conoscopic mode of operation, each point corresponds to one specific direction of light propagation. In analogy to the *directions image* (*conoscopic image*) the results of the first measurements of LCD contrast versus viewing direction have been graphically represented as lines of equal contrast (i.e. *iso-contrast lines*) in a polar coordinate system [2]. This visualization is self-explaining and intuitive, and moreover it provides a direct relation to the interference figures well known from conoscopic observations of liquid crystalline layers (e.g. the "Maltese cross" that is formed when a twisted nematic structure approaches a homeotropic alignment under the effect of an increased electric field, see e.g. [3, 4]).

Sophisticated manufacturers of LCDs published one contrast contour diagram in their catalogues for each type of LCD and sometimes also for various driving voltages. From the variation of contrast with viewing direction a range of integral characteristics (e.g. average and directionally weighted average values) could be derived and specified according to the individual needs of the customer and the requirements of the application.

LCDs improved over time from hard-wired devices that could display numbers and symbols (with 7 to 16 segment electrode layouts) to gray-scale display and finally to full-color display with high spatial resolution. Metrology for such improving device performance and related evaluations also evolved over time with an emphasis on gray-scale reduction and inversion [5], and then on color fidelity [6] over a wide range of viewing directions for a variety of different LCD technologies [7] for demanding applications (e.g. medical diagnostics).

In the meantime, LCD monitors have made their way into the offices around the globe as computer monitors and early in 2008, for the first time, more LCD-based TV-sets have been sold on this planet than TV-sets with cathode rays tubes (CRTs) according to a Display Search announcement in February 2008.

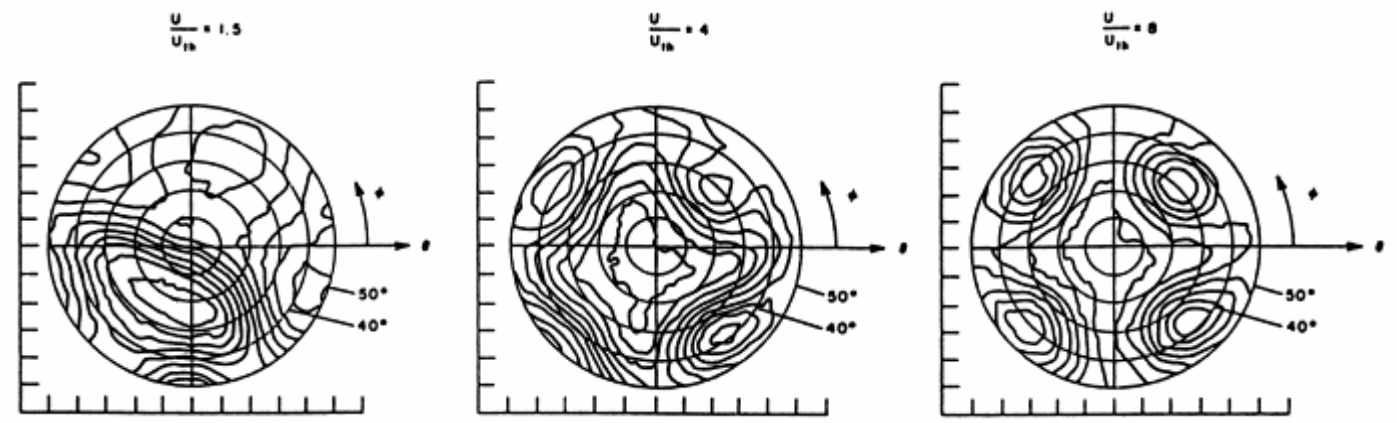


Figure 1: The first contrast contour diagrams measured with a motorized goniometric scanning device (DMS), from the diploma thesis of Michael E. Becker (University of Karlsruhe, 1979), then published in the first issue of Displays *[2]. The measurements have been carried out for driving voltages of 1.5, 4 and 8 times the threshold voltage.*

The increasing competition for better computer monitors and better TV-sets has also pushed the limits for the electro-optical properties of LCDs to limits that can only be overcome by visionary marketing specialists: many "viewing angle" specifications for LCD computer monitors and TV-sets have arrived at 178° and not yet trespassed that limit for reasons of deference, not however out of respect for the customer, common sense or even ergonomics.

So these days you can go to your local electronics supermarket and acquire a TV-set with "wide viewing angle 178° x 178°" which surely sounds impressive, even though you might ask yourself why two degrees have been left missing to 180°.

From "viewing angle"... When a visual display with non-vanishing size is seen by an observer, every point of the display area is seen from a different direction as illustrated in *Figure 2* for a cyclopic (i.e. one eyed) observer. The larger the display is and the closer the observer is to the display the more the viewing direction varies over the surface area of the display.

The *viewing direction* is specified by two polar angles: the angle of inclination, θ (measured from the surface normal of the display) and the azimuth angle, Φ, measured in the plane of the display as shown in *Figures 2 and 3*.

...to viewing cone: The multitude of directions from which a display can be seen without artifacts and distortions that would render its intended use impossible (e.g. computerized office work, television, entertainment) is called the *viewing cone* (even though its shape might be that of a generalized cone).

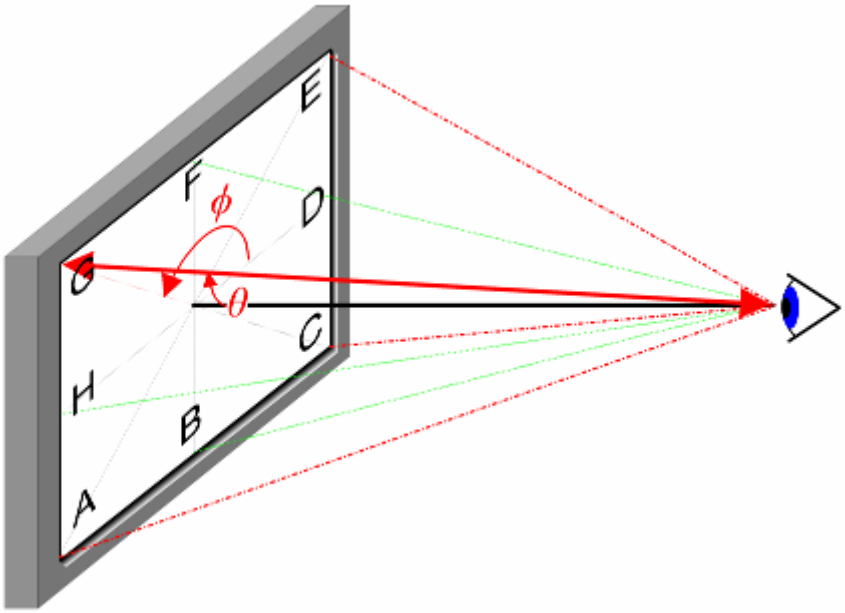


Figure 2: Illustration of the variation of the direction of observation (i.e. viewing direction) across the area of the display. All locations on the surface area of the display screen are seen from a different direction. The viewing direction is specified by an angle of inclination, θ (measured from the surface normal of the display) and the azimuth angle (in the surface plane of the display).

The concept of the *viewing cone* has been introduced for the first time in the international standard ISO 13406-2:2001 "Ergonomic requirements for work with visual displays based on flat panels - Part 2: Ergonomic requirements for flat panel displays". This standard provides a classification for computer monitors with LCDs according to the range of viewing directions that can safely be used for the intended task (here: office work) without "reduced visual performance". The classification is according to "Viewing Direction Range Classes" with the "range of viewing directions" being equivalent to the viewing cone.

ISO 13406-2 [8] describes a complex procedure according to which the usable viewing cone can be evaluated from measurements of luminance and chromaticity versus direction of observation. ISO 13406-2 introduces 4 viewing direction range classes of which the first (class I) features a *wide viewing cone* for a multitude of simultaneous observers and the last (class IV) is a so called "privacy display" with a severely limited viewing cone.

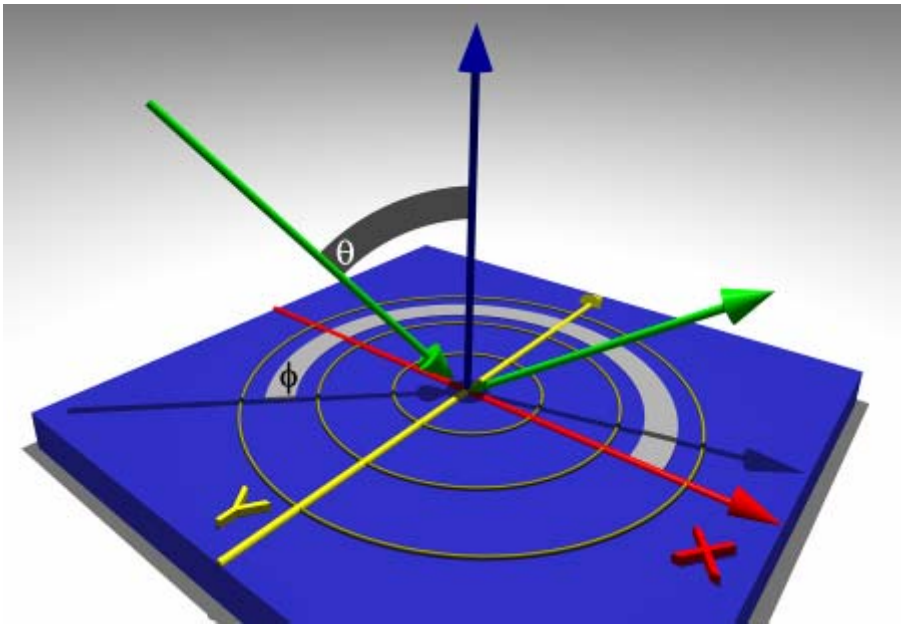


Figure 3: The green arrow on the left is the viewing direction (i.e. direction of observation) specified by the angle of inclination, θ, measured from the surface normal of the display (vertical arrow) while the azimuth angle, Φ, is the angle that the projection of the viewing direction onto the surface of the display makes with the x-axis. The projection of the viewing direction is shown here as the shadow of the green arrow. The azimuth angle Φ increases counterclockwise from the x-axis (3:00) as illustrated.

Depending on the actual task to be performed with a certain display device (e.g. office work, entertainment, home theater, etc.) the requirements for the display performance are different. Compliance routes for different display applications can now be found in the successor standard ISO 9241-300 [9] which has a scope that extends beyond office work.

Viewing directions are conveniently represented in a polar coordinate system with the angle of inclination, θ, being represented by the radial distance from the origin and the azimuth, Φ, increasing counterclockwise as shown in *Figure 4* with the x-axis being the reference direction (als called 3:00 direction). In this coordinate system every point corresponds to one viewing direction. A viewing cone is thus defined by a locus (a closed line) in this coordinate system as indicated by the rectangle and the ellipse in *Figure 4*. If a viewing cone is specified by four directions only (e.g. in the horizontal and the vertical plane), it does not become clear if it is the rectangle or the elliptical cone according to Figure 4. In order to resolve this ambiguity, the viewing cone should be specified by at least 8 directions, located in the horizontal and vertical plane and in the two diagonal planes (Φ = 45° and 135°).

Each direction in the polar coordinate system of *Figure 4* can be assigned a (scalar) physical quantity, e.g. luminance, contrast, etc... This quantity can then be represented by lines of equal values (contour lines), by shades of gray or by pseudo-colors (as shown in *Figures 4 and 6*).

- A *viewing cone* can be defined starting from a certain application and the related geometry of observation, from which a range of directions can be derived specifying the *viewing cone* geometrically required for that task. Inside this viewing cone certain physical parameters that are related to the visual performance of the display device must remain within certain (task dependent) limits.

- A *viewing cone* can also result from measurements (versus viewing direction) carried out with a certain display device under specified operating conditions. Then the viewing cone is obtained by limiting values of a visual quantity (e.g. contrast), which for a certain application is required to be above e.g. 10 (compare e.g. VESA FPDM2 307-4 Viewing-cone thresholds). Then the line for which the contrast equals 10 defines the viewing cone.

Recent experiments [10] have shown that the acceptable viewing cone is rather determined by decrease of luminance and change of chromaticity than by the decrease of contrast.

Luminance, contrast and chromaticity versus viewing direction: *Figure 6* illustrates the variation of luminance and contrast of an IPS-LCD with viewing direction in a polar coordinate system. The left column shows the directional luminance distribution of the dark state of the display, the center column shows the bright state and the right column shows the (luminance) contrast (ratio) resulting from the preceding two luminance distributions. The values are coded by pseudo colors. The graphs below the polar coordinate systems each show the corresponding cross sections in the horizontal plane and indicate the numerical values for luminance and contrast. Each borderline between two shades of colors represents a line of constant value, in the case of contrast an iso-contrast (contour) line. Note, that "iso" is used here in the sense of "equal", it does NOT establish any relation to the International Organization for Standardization, ISO.

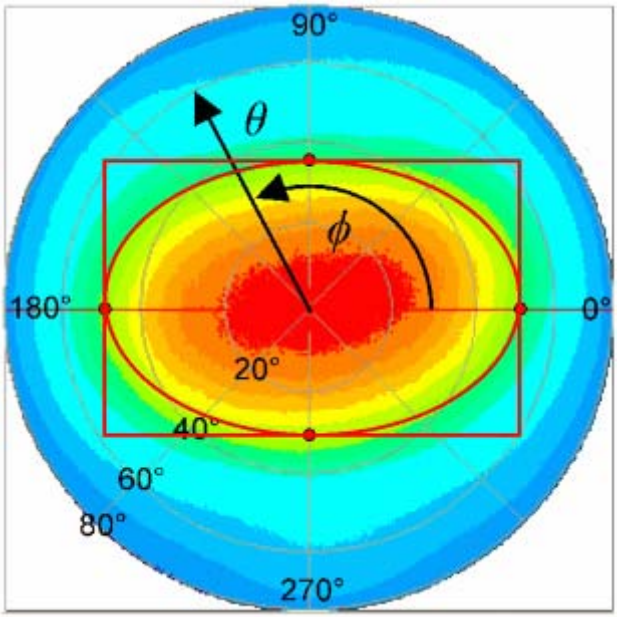


Figure 4: Illustration of the specification of the range of viewing directions (aka viewing cone) in a polar coordinate system. Each point in this coordinate system corresponds to a viewing direction with the distance from the center representing the respective angle of inclination, θ, and the azimuth, Φ. The pseudo-colors represent the value of a physical quantity (e.g. luminance) for each viewing direction.

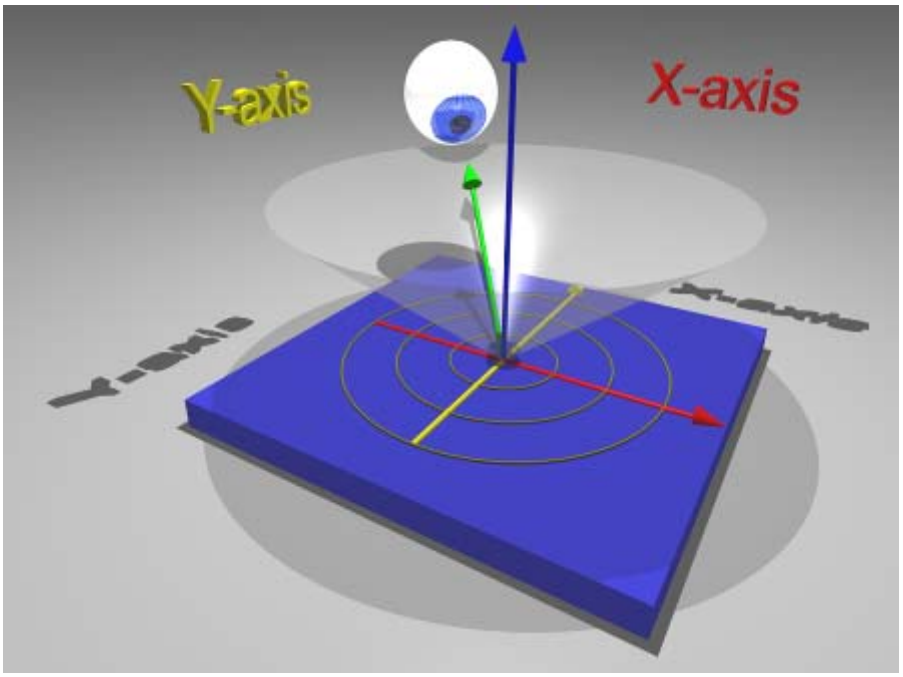


Figure 5: Illustration of an example of a viewing cone centered about the surface-normal of the display. This viewing cone can be represented in a polar coordinate system (e.g. fig. 4) by a circle around the center with the angle of inclination as radius. In general, a viewing cone may be tilted and distorted, i.e. of a less regular shape than shown here.

Since chromaticity is a vectorial quantity and thus cannot be represented in a single polar coordinate system it is convenient to resort to e.g. the color difference with respect to a reference direction (e.g. ΔE* with respect to the normal viewing direction), or to represent each component of the chromaticity (e.g. u', v') in a separate polar coordinate system.

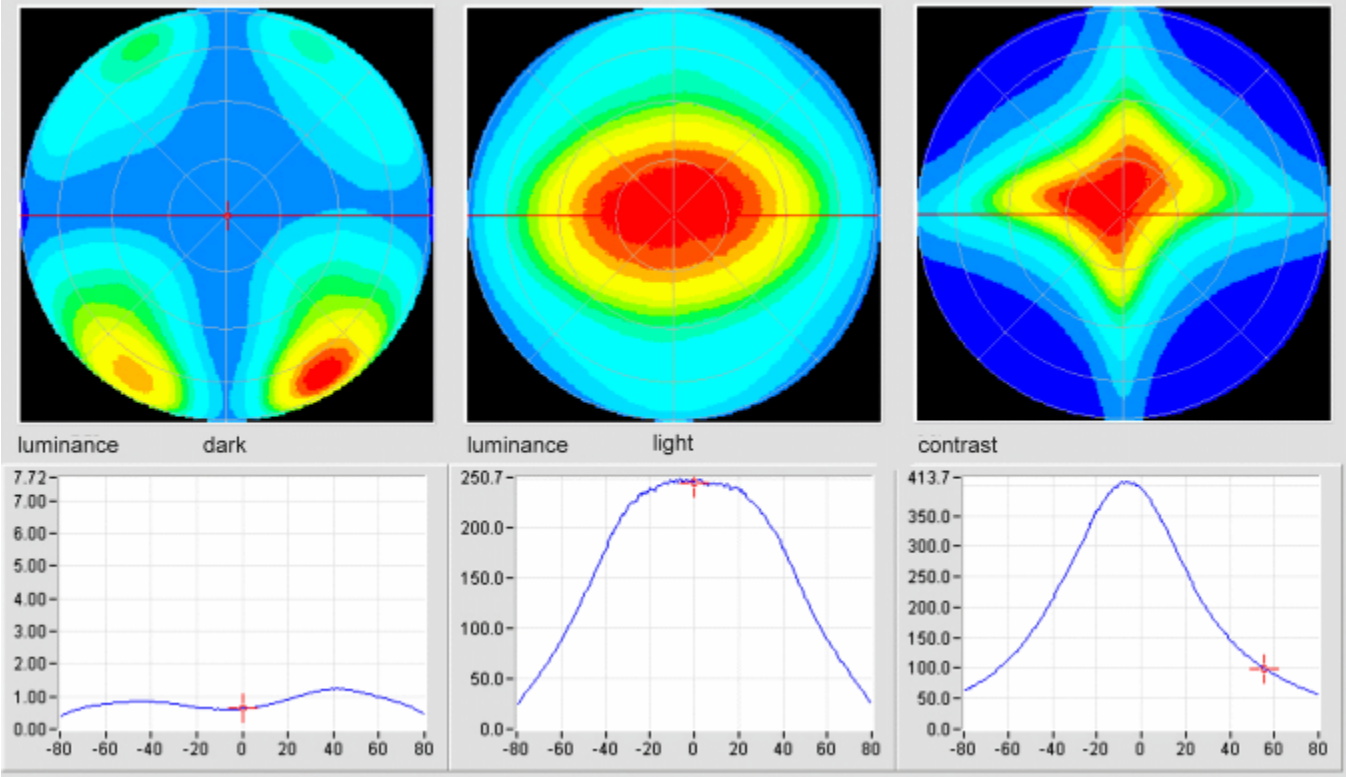


Figure 6: Luminance and contrast versus viewing direction in a polar coordinate system. The left column shows the directional luminance distribution of the dark state of the display (IPS LCD), the center column shows the bright state and the right column shows the (luminance) contrast (ratio) resulting from the preceding two luminance distributions. The values are coded by pseudo colors. The graphs below the polar coordinate systems each show a cross section in the horizontal plane and indicate the values for luminance and for the contrast. Each borderline between two shades of colors represents a line of constant value, in the case of contrast an iso-contrast (contour) line. Note, that "iso" is used in the sense of "equal", it does NOT establish any relation to the International Organisation for Standardization, ISO. These evaluations have been carried out with a ConoScope from Autronic-Melchers.

Trimming the wings of the "viewing angel": Since there is no international standard to which the numbers "178° x 178°" from LCD data-sheets refer to, they are as meaningless for the actual application as they are supposed to be impressive. It is assumed that in most of the cases the numbers "178° x 178°" are meant to specify the angle of inclination for which the contrast reaches the limiting value of 10. This however does not provide any information about luminance and chromaticity at these angles of inclination and thus does not specify the visual performance of the display.

When two numbers are encountered in such "specifications" they sometimes come with indices "h" and "v", which means that the numbers are supposed to specify two ranges of the angle of inclination in the horizontal and vertical plane, i.e. at values of the azimuth angle of 0° and 180° (horizontal plane) and of 90° and 270° (vertical plane). When an LCD-monitor is used for office work it should be taken into account that, at an angle of inclination of 45°, any character displayed on the screen is appearing foreshortened by ~30%, a purely geometrical effect which is limiting the usability of the display even with all electro-optical characteristics remaining constant.

In a recent comprehensive investigation initiated by Philips (Consumer Electronics and Research Laboratories), comparisons between experiments and measurements have been carried out in order to identify the quantities and

the corresponding limiting values that define the apparent *viewing cone* for television screens with LCDs and PDPs [10]. One of the results is that "the luminance at intermediate-to-high gray levels determines the viewing-direction dependent quality and not the contrast ratio." This is found to be in agreement with other research results that "find a low correlation between contrast ratio and visual assessment value". Furthermore, "not only the chromaticity coordinates of the primaries, but even more those of the white point play an important role and need to be included in a viewing direction dependent metric". The authors conclude that "for LCDs, this new metric results in a viewing cone, which is on the order of 70°–90° (subtended angle), and thus, considerably lower than what is usually specified based on a minimum contrast of 10. For PDPs, this new metric yields the same viewing direction range as the present specification that uses a luminance decrease to 50%".

In the terminology as introduced above (and illustrated in *Figure 5*) a viewing cone of 70°–90° subtended angle means (for a rotationally symmetric viewing cone) a maximum angle of inclination of 35°-45°.

Conclusions:

- The *viewing cone* is a range of *viewing directions* that satisfies specific task dependent performance requirements.
- The *viewing cone* shall be specified by at least four directions, it should preferably be specified by 8 directions (see *Figure 4*).
- Any specification of a *viewing cone* requires the specification of the related limiting values and quantities (minimum of luminance, contrast, limit values for chromaticity, etc.).
- Exaggerated *viewing cone* specifications found in data sheets (e.g. "178° x 178°") are meaningless since they are based on an (equally meaningless) contrast limit of 10.
- More reasonable evaluations show that the *viewing cone* of state-of-the-art LCDs are in the range of 70° - 90° subtended angle of inclination.
- The international standard ISO 9241-300 (FDIS stage) supports the definition of a variety of viewing cones for electronic display devices in dependence of the intended application. This standard should be taken into consideration after its final release.

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[6] T. Fiske, L. Silverstein, *Characterization of viewing-angle dependent colorimetric and photometric performance of color LCDs*, Proc. SID'93, pp. 565-568

[7] S. L. Wright, et al., *Status of TFTLCD Color and Metrology*, IBM Research Report RC 21718 (97804), 6 April 2000

[8] ISO 13406-2:2000 "Ergonomic requirements for work with visual displays based on flat panels -- Part 2: Ergonomic requirements for flat panel displays."

[9] ISO 9241-300: "Ergonomics of human-system interaction -- Part 300: Introduction to electronic visual display requirements." The ISO 9241-300 series establishes requirements for the ergonomic design of electronic visual displays. These requirements are stated as performance specifications, aimed at ensuring effective and comfortable viewing conditions for users with normal or adjusted-to-normal eyesight. Test methods and metrology, yielding conformance measurements and criteria, are provided for design evaluation. ISO 9241 is applicable to the visual ergonomics design of electronic visual displays for a diversity of tasks in a wide variety of work environments.

[10] K. Teunissen, et al., *A perceptually based metric to characterize the viewing-angle range of matrix displays*, JSID 16/1(2008), pp. 27-36

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11:15 AM - 12:30 PM
Digital Signage at Work Today

1:30 PM - 2:40 PM
Distribution = The Glue than Binds Vendors, Integrators and End-Customers

2:40 PM - 4:00 PM
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4:20 PM - 5:35 PM
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I want my OLED TV! But is it just wishful thinking?

by Darice Liu

Darice Liu specializes in display and semiconductor capital equipment companies as vice president of Equity Research at Maxim Group. Prior to joining Maxim, Ms. Liu covered the same sectors at C.E. Unterberg, Towbin for four years. Ms. Liu's previous experience also includes equity research at Needham & Company and risk management analysis at PricewaterhouseCoopers LLC. She holds a BA degree in Environmental Science from Columbia University.

Dreaming of OLEDs… Imagine a television that is cardboard thin, so lightweight a single person could pick it up effortlessly and displays an image with the brightness, color and clarity that the human eye would relish and appreciate. Imagine waking up in the morning and opening an electronic newspaper, which is plastic, roll-able and reusable. Imagine a room with electronic wallpaper programmed to display your computer work or favorite television show. Imagine a transparent map on your car's windshield that helps you find your way home. This is a mere glimpse at the wonders and possibilities of what could occur with the advancement of OLEDs.

Feeling jilted… Unfortunately, the wonders of OLED technology have been overshadowed by the numerous disappointments. The industry can be best described as a "field of broken dreams". With a number of false starts and players entering, re-entering and even exiting the game, the industry's growth rate has been stunted repeatedly over the past 10 years. We believe, though, that the investment momentum is finally picking up and that the industry is poised for growth, but we anticipate a few (if not many) bumps in the road. Here's a list of what to keep an eye on while gauging whether the industry is moving in the right direction.

Technical/manufacturing progress:

- **Blue & extending lifetimes.** A true blue has long been an issue and remains so today, in terms of depth (color saturation) and lifetime. As we migrate OLED technology from handsets to televisions, brand manufacturers are looking for colors to last ~100,000 hours. Most reds and greens approach or meet that time quota, but today's best blue lasts ~20,000 hours.
- **SMOLEDs: making it solution processable.** Currently, the majority of handheld applications use small OLED (SMOLED) molecules that can only be used in a vacuum manufacturing process. As we move to larger formats, inkjet printing or roll-to-roll printing is expected to be the mainstream technology, where the molecules must be solution processable. Note that polymer OLEDs (POLEDs) are solution processable.
- **Improving LTPS backplane technology.** We believe that one of today's major yield issues stems from creating the low-temperature polysilicon (LTPS) backplane. The current mainstream backplane technology used by most LCD manufacturers is a-Si (amorphous silicon).
- **Improve yields, lower costs.** Today's AMOLED screen for cell phones ranges from $10-$20, versus an LCD screen which costs less than $5. This BOM (bill of materials) differential needs to be lowered if further commercialization is expected, in our opinion.

Follow the AMOLED leader:

- **Watch Samsung SDI.** A few players have been reviving their OLED investments, but Samsung SDI, which plans to double capacity this year, is the only one that has created a dedicated fab to AMOLED. If Samsung SDI can profit from this technology, we believe that many others will quickly follow. Chi Mei El ranks number two in AMOLED spending, with LG Display trailing as number three. Samsung Electronics has made some recent noise about OLED TVs, as well as Japanese players Toshiba, Panasonic and Sony.

Product proliferation and acceptance:

OLED market adoption: As manufacturers introduce OLED products into the market, we would remain watchful

of the number of products introduced and the resulting consumer adoption. Early price points for OLEDs are expected to be higher than that of its peers, and the products will likely be considered more of a high-end niche.

Solid-state lighting and flexible display markets:

Beyond "The Holy Grail" of televisions: While many companies are focusing on the move from small to large displays, we are watchful of companies leveraging OLED technology into other markets, most notably solid-state lighting and flexible displays.

While OLED technology still faces a number of hurdles, we believe that the investment cycle is getting stronger by the day and expect continued progress in the field. We maintain our dream of owning an OLED TV one day and assert that it will be a matter of "when" and not "if".

How to find TVs with the best value

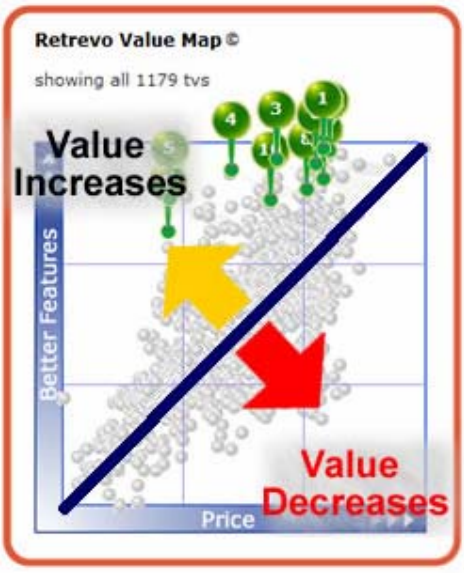
by Andrew Eisner

Andrew Eisner is a former test manager for Ziff Davis Labs and is currently director of content for Retrevo.com a website specializing in consumer electronics. Retrevo has reviews, manuals, and buying information for all popular gear and gadgets.

Retrevo (http://www.retrevo.com) is a website which specializes in consumer electronics and the people product interface. They call themselves the matchmaker for people and electronics. They have applied algorithms and web technology to determine if a product is a good or bad value and whether the review community, both experts and users, agree. The history of Retrevo is steeped in artificial intelligence. The founding engineers first developed a system for finding relevant support information in an enterprise environment. They redirected their expertise in artificial intelligence disciplines including clustering, classification, pattern recognition, machine learning and other techniques to find relevant information for consumer electronics product information. The result is a web site the delivers quality information to buyers and users of consumer electronics products like LCD TVs, digital cameras, laptops and more.

The value map plots price vs. features

Recently, Retrevo undertook the task of providing consumers with a graphical representation of a cluster of products plotted on a chart according to price vs. performance or features. The result is what Retrevo calls their "Value Map." Retrevo's Value Map is based on years of research in pattern recognition combining advanced methods in multivariate Bayesian decision theory, supervised machine learning and mark-to-model valuation techniques.



How it works: Retrevo first determines the price-feature position of each product by analyzing hundreds of thousands of product features (e.g., supported resolution for HDTV sets) and current street prices. The result of this analysis is a crisp visual presentation and textual summarization of a product on a product category map along price-feature axis. The distribution of all normalized product feature values is further analyzed to identify clusters of products with common features forming the basis for the product class summary.

Retrevo then determines the fair value of each product based on its feature set and its proprietary mark-to-model valuation technique. A value rating is computed for each product that reflects the deviation of current price of that product from its fair value. Since the market conditions change on a daily basis and new products with new features are introduced frequently, a product's fair value and value rating assessment also changes constantly. This analysis is completely algorithmic and automated. It aims to provide a

holistic and objective fact-based product evaluation. The time when the latest analysis was performed is displayed along with the summary. Users can always get the real-time value assessment of a product.

This screenshot shows the Retrevo Product Advisor with a Value Map for LCD TVs. When this map was produced the Olevia 747I came up as a high value product. Retrevo's interactive Value Map allows users to mouse over hundreds of products to identify the product and see a price range. Consumers may further refine their choices by using the personalization feature. The Retrevo Value Map allows consumers to quickly compare a large number of products and shop by their desired value.

Community reviews and sentiment factors

While the fact-based summary provides a very objective assessment of products based on current market conditions, qualitative information associated with the brand including both end user and expert reviews and opinions also play a very important role in a consumers buying decision. Retrevo crawls the Web for expert and user reviews and opinions for a given product and analyzes them for sentiment for that product. A single “Community Sentiment Rating” is computed for a product based on a weighted combination of the expert and user opinions for that product. The weighting is computed using a set of proprietary and automated mathematical formulae that not only weights each opinion but also weights the domain of the website containing the review based on the variation of all (and category-specific) product ratings found associated with that domain. Retrevo's analysis is based on over a million expert and user opinions on the Web. The Sentiment Rating for a product is displayed along with the total number of user and expert opinions that it was computed from.

Here's a list of three LCD TVs that have been determined by Retrevo's sentiment and value analysis to have good bang for the buck. The "Good Value"

thumbs up indicates a high Value Map position and good ratings from experts and users results in a "Community Positive" thumbs up. Aggregated reviews offer a quick assessment of user sentiment.

Retrevo plans to initiate an MVP list for "Most Valuable Product," and will be announcing products that make the list in the near future. You can see a Retrevo Value Map for TVs at http://www.retrevo.com/s/hdtv Retrevo is not only a source for buying information. Consumers can find manuals for all popular consumer electronics products and can search inside PDF manuals to find the exact page in the manual for the information they need.

About the LCD TV Association

The LCD TV Association is a global, non-for-profit marketing trade association, formed to help the entire LCD supply chain and retail channel through to the end consumer via various communication tools, including speeches, interviews, sponsored research, as well as industry newsletters, meetings and standards settings – resulting in better information and distribution of this information, as well as better understanding of the rapidly changing world of flat TVs and HDTVs for all related parties. Participating at the many industry trade and consumer shows around the world to help promote members' interests, as well as create better LCD TV products for everyone, our goal is to serve both the industry needs and promote the consumers best interests. We encourage and engage in discussions to promote the industry overall, as well as helping foster healthy competition and create better products with higher value propositions for consumers and retailers alike. The LCD TV Association can help fight the growing "specsmanship" in trade publications and refocus conversations on true image quality and understanding for consumers, and help the whole LCD TV ecosystem to improve and thrive. For more information on the LCD TV Association, it's membership, or to join at one of the various levels available, please visit us on the web at http://www.LCDTVAssociation.org.

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June 5-6, 2008
Hilton San Diego Resort
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The TV supply chain is in a state of transition. Today's industry faces market commoditization, thinning profit margins, economic uncertainty and a lack of industry best practices. To achieve success, global retailers, suppliers and brands must understand the current state of the industry and be able adapt to this rapidly changing marketplace. No company does a better job of offering a timely, accurate and comprehensive view of the TV industry than DisplaySearch, the worldwide leader in TV supply chain analysis and consulting.

The 2008 DisplaySearch TV Supply Chain Conference is dedicated to bringing together leading organizations and individuals across the TV supply chain for two days of insight, knowledge and networking. This is your opportunity to gain access to the industry's key players and strengthen your strategic alliances as you learn tips and tactics to improve efficiency, best practices and ROI.

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TV Supply Chain Conference

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Reasons to Attend:

Experience the entire supply chain:

This year's TV Supply Chain Conference offers a complete view of the TV supply chain. Event sessions follow a logical flow, starting at component manufacturers and continuing all the way to retailers. It's a unique approach that mirrors the real world, allowing you to recognize new business opportunities that might not otherwise be visible.

Industry leading analysts:

Meet the brightest minds in the business. The TV Supply Chain Conference offers valuable access to DisplaySearch's renowned team of industry analysts. Representing decades of industry experience, these supply chain experts have the insight, experience and knowledge your organization needs to thrive. Don't miss your opportunity to benefit from this uniquely talented group.

Networking opportunities:

See hundreds of people. Save thousands of dollars. DisplaySearch's comprehensive approach serves up your most important partners, customers, suppliers, and prospects under one roof. It's your chance to mingle with the market's most important players without having to spend thousands in travel expenses.

Instant ROI:

It's the conference that pays for itself. Experience instant ROI with actionable analysis and insight that will help you establish more efficient and cost-effective ways of doing business. In addition, you'll get to size up the marketplace and recognize new business opportunities for your organization.

Key Questions Answered:

This event addresses a number of pressing industry questions, including:

- How will recent LCD TV panel price increases affect TV prices this holiday season?
- How are margins likely to change over the next 12-24 months?
- How can brands plan to maintain differentiation in the face of market commoditization?
- How much cost reduction can be realized through greater supply chain efficencies?
- What new technologies are coming to market, and how will they change performance, competition and pricing?

Who Should Attend:

- Brands
- Panel Suppliers
- Equipment Manufacturers
- Design Manufacturers
- Equipment Suppliers
- Component Suppliers
- Retailers
- Media
- Financial Analysts

Register at www.displaysearch.com/tvsupply

Sponsorship Opportunities:

To find out more about sponsorship and exhibit opportunities, contact Heather Boudreau at 516.625.6133 or heather_boudreau@displaysearch.com.

Agenda:

Thursday, June 5

8:30 AM - 10:15 AM
US TV Market Outlook and Opportunities

10:30 AM - 12:30 PM
Will Global Brands Control Panel Supply?

2:00 PM - 3:25 PM
TV Technologies: Are Smart Panels a Better Solution?

3:45 PM - 5:30 PM
TV Assembly Challenges: Recognizing When and How to Outsource

Friday, June 6

8:00 AM - 10:00 AM
Supply Chain Management

10:15 AM - 11:45 AM
Future of TV - Part 1

1:00 PM - 2:00 PM
Future of TV - Part 2

2:15 PM - 3:00 PM
Retailers Panel

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HDTV coming in new ways…

by Alfred Poor

Alfred Poor is the editor and publisher of "HDTV Almanac", a free daily service of news and commentary on the HDTV, digital television, and home entertainment electronics markets: http://hdtvprofessor.com/HDTVAlmanac. This article comprises four recent entries about current events in the HDTV industry. .

The Internet changes everything

About 15 years ago in the personal computer industry, we had a saying: "The Internet changes everything." We couldn't foresee Skype or iTunes or Google or Amazon (or else we'd be bazillionaires now), but we knew something was afoot. Instead of having to put data in our PCs from floppy disks, or by dialing into a remote server with a modem, the Internet held out the promise of a broad expanse of information that was going to be readily available in new ways that we couldn't imagine.

It has taken a bit longer for the Internet to have the same impact on television and video content, but it's definitely here and growing all the time. Still, we're in the "spaghetti stage"; publishers are still throwing stuff at the wall in an effort to find out what sticks.

The fundamental problem is that we've grown up with a basic expectation about television; it's easy to use. Just press a button on the remote and you can see something different. When you have a half dozen or a dozen locally broadcast television stations, this simple interface works fine. When you have a cable or satellite service with hundreds of channels, it gets a bit more cumbersome. In these cases, you want access to a programming guide that tells you what's on, and makes it easy to get to that channel.

But what do you do when there aren't "channels" and you can choose among programs that are available whenever *you* want to watch them? Ah, there's the rub. How do you impose order on the apparently boundless world of the Internet, without walling off access to content that you may want to view?

The result of this conundrum is that content producers and publishers are exploring lots of different avenues to use the Internet to deliver video content to your computer. Frankly, we're still in the Wild West frontier stage of development, but some of the current initiatives are particularly intriguing as they point to where we may be headed.

Netflix thinks inside the box

For example, it has been reported recently that Netflix has expanded its partnerships with set-top box makers. In addition to their existing deal with LG Electronics, the company expects to announce three more partnerships that will let subscribers watch movies on their TVs, streamed directly from the Internet. The Netflix CEO stated that we can expect to see products from all four companies that incorporate the streaming functions before the end of this year.

According to reports, the online streaming will be bundled with the regular subscription plans at no extra charge. Netflix already has about 9,000 movies and TV episodes available on their PC service that lets subscribers view content on their computers, but this is still a small number compared with about 100,000 movie titles in their DVD-by-mail service.

As postage rates continue to rise, Internet delivery of movies makes a great deal of sense, and set-top box partnerships should make selecting a Netflix movie as easy as picking a channel or any cable video-on-demand program. This is clearly where the movie rental market is headed, and it looks as though we're going to be able to enjoy Netflix this way starting later this year. The big problem then will be how fast the company can convert its physical library for digital distribution.

Sony bringing IPTV to PS3

Sony has made big news recently about delivering video content through the Internet to another type of box: a video gaming console. The information is found in a posting on their Playstation.Blog that is attributed to Peter Dille, Senior Vice President, Marketing & PLAYSTATION Network. Here's what he wrote:

> "Many of you have been hearing rumblings about a video service that will allow you to download full-length TV shows and movies via PLAYSTATION Network for North America. While I don't have any new announcements here for the PlayStation Nation, it's already been confirmed that we'll be offering a video service for PS3 in a way that separates the service from others you've seen or used. Ultimately the goal of the PLAYSTATION Network service will be to break through the overwhelming clutter of digital media to give you the TV, movies and gaming content you want. More on this very soon …"

The key words in this statement are "video service" and "give you the TV, movies and game content you want." That's a pretty broad spectrum of programming, and sounds like a serious commitment on Sony's part to deliver this content over the Internet. The market research firm iSuppli predicts that there will be 20.3 million PS3s out there by the end of this year, reaching 38.4 million units by 2011. This is still small potatoes compared with the number of TV sets out there, but certainly could be enough to make a meal on... It remains to be seen if this is the same "walled garden" approach used by the optional Internet connection available for some Sony LCD HDTVs, or if the PS3 Network will have a different approach with different content.

Movie clips on FaceBook

Then there is the question of the content available on the Internet. Many social networking sites have provisions for including video content, and users are posting clips like crazy. As the Rainman might say, "there are thousands and thousands of them."

At a time when most of the copyright holders for music, movie, and video content are going bananas trying desperately to lock up their products and prosecute anyone who misappropriates their product, Paramount is taking a different approach. The company is embracing the new reality of Web-based social networks, and is making thousands of short clips from its movies available to FaceBook users through its new VooZoo application. Clips last from a few seconds to several minutes, so now you can put Eddie Murphy or Charlton Heston on your FaceBook page.

Paramount hopes that this effort will help them market both existing DVD titles as well as new theatrical releases (such as the upcoming Indiana Jones movie). This seems to make a lot of sense to me, and one that other companies would do well to emulate. There's nothing like a great catch phrase from your favorite movie to liven up your page and provide another peek at what makes you tick. (Sadly, Paramount doesn't have the rights to the clip that I'd want to post: "When will then be now?" "Soon…")

You catch more flies with honey than vinegar, and it looks like Paramount is willing to experiment with a sweet approach to getting its content out in distribution. Expect to see other companies follow suit (especially if you and all your FaceBook friends sign up for VooZoo).

Hooked up HDTV

Two problems stand in the way of getting Internet content on your television. One is the user interface, that helps you navigate among the choices, but the other one is simply how the images get to the screen. As mentioned above about in the Netflix and Sony stories, you can go with a separate box. Another option is to use a computer and hook up the video output to your television. But there's a third approach: connecting your television to your home network so it can share a broadband connection to the Internet.

According to a new report from ABI Research, it's a question of "when" your TV will connect to your home network, not "if". Consumer electronics are becoming increasingly dependent on network connections for the distribution of images and sounds. And televisions are right in the path of this juggernaut. According to ABI Research, about 3.6 million HDTVs will ship with network connections in 2008. LG, Sony, and HP already have products on the market with such features, but in just five years, the number of televisions with network connections will soar to 65 million units in 2012.

Part of this movement is an attempt by manufacturers to differentiate their products in an increasingly competitive and crowded market. But I also see it as a strong response to the shifting tides in consumer electronics and content delivery. Instead of having shoeboxes of snapshots and shelves crammed with CDs (or cassettes or LPs), more and more families have hundreds of gigabytes of images and music stored on home computers. People are beginning to want easier ways to access this content, and burning mix CDs is not the answer. Instead, home networks let them access their content in different places. A television that makes this process easy will be in great demand.

But that's just the tip of the iceberg. The Internet has already become a major means of distributing commercially produced content. I've bought a lot more music through downloads than on CDs in the past year, and I know that my experience is not much different than for millions of others. And as consumers become more comfortable with using the Internet this way – and televisions make it easier – we'll be renting and buying more and more movies and other video content. Adding network connections to televisions is not just a good idea, it will be a necessity in just a few short years.

2008 Display Industry Calendar of Events

A detailed calendar with active URLs is maintained by Veritas et Visus. Please notify mark@veritasetvisus.com to have your future events included in the listing. http://www.veritasetvisus.com/industry_calendar_2008.htm.

January 2008			
January 6-9	Game Power and Mobile Entertainment	Las Vegas, Nevada	Digital Hollywood
January 7-10	2008 International CES	Las Vegas, Nevada	International CES
January 11	LEDs in Displays	Costa Mesa, California	SIDLA
January 14-18	MacWorld Expo	San Francisco, California	Macworld Conference & Expo
January 15-16	Metalization and Dielectrics	Stratford-upon-Avon, England	
January 17	Practical Light & Color Measurement	Birmingham, England	Photonics Cluster (UK)
January 19-24	Photonics West 2008	San Jose, California	SPIE The International Society for Optical Engineering
January 21-24	Flexible Microelectronics and Displays Conference	Phoenix, Arizona	USDC
January 22-24	ATEI 2008	London, England	ATEI
January 24	Korea FPD Conference	Seoul, Korea	DisplaySearch
January 27-31	Electronic Imaging 2008	San Jose, California	Electronic Imaging
January 28-30	Stereoscopic Displays and Applications	San Jose, California	Stereoscopic Displays and Applications
January 29-31	Integrated Systems Europe 08	Amsterdam, Netherlands	infoComm
January 30-31	Japan Forum	Tokyo, Japan	DisplaySearch

January 30-31	Grand Challenges for Emerging Technologies in Displays	Cambridge, England	
January 30 - February 1	Video Forum Europe	London, England	
January 30 - February 1	Semicon Korea	Seoul, Korea	
February 2008			
February 5-6	Screen Expo Europe	London, England	
February 7	AC Electroluminescence	Swansea, Wales	
February 7-9	CEA 2008 Winter Retreat	Park City, Utah	
February 11-13	Strategies in Light Conference	Santa Clara, California	
February 12-15	Display Metrology Short Course	Boulder, Colorado	
February 13-14	Image Processing and Optical Technology	Birmingham, England	
February 15-17	Symposium on Interactive 3D Graphics and Games	Redwood City, California	
February 16-21	Medical Imaging	San Diego, California	
February 18-22	Game Developers Conference	San Francisco, California	
February 20-21	RFID Smart Labels	Boston, Massachusetts	
February 22-24	Sound & Vision 2008	Bristol, England	
February 24-27	Focus on Imaging	Birmingham, England	
February 26	Transistors on Plastic	Maccelsfield, England	
February 27-28	Electronic Displays 2008	Nuremberg, Germany	
March 2008			
March 3-4	Business Goes Green	San Jose, California	
March 3-5	Global Phosphor Summit	San Diego, California	
March 4-9	CeBIT 2008	Hanover, Germany	
March 5-6	LED China 2008	Guangzhou, China	
March 6	HD Expo	Beverly Hills, California	
March 6	Displaybank New York Conference	New York, New York	
March 8-9	Symposium on 3D User Interfaces	Reno, Nevada	
March 8-12	Virtual Reality 2008	Reno, Nevada	

March 10-13	Showest 2008	Las Vegas, Nevada	
March 10-14	2008 Measurement Science Conference	Anaheim, California	
March 11-12	Investigating 3D Technologies and Projection Displays	Leicester, England	
March 11-13	FPD China	Shanghai, China	
March 11-13	Air Traffic Control	Amsterdam, Netherlands	
March 11-13	US FPD Conference	San Diego, California	
March 11-15	EHX	Orlando, Florida	
March 12-13	Media Summit	New York, New York	
March 12-14	DVB World 2008	Budapest, Hungary	
March 13-14	Microdisplays, Applications, and Optics	Jena, Germany	
March 13-14	Symposium on Haptic Interfaces and Virtual Environments	Reno, Nevada	
March 17-19	Digital Holography and Three-Dimensional Imaging	St. Petersburg, Florida	
March 18-19	Digital Living Room	San Francisco, California	
March 18-20	Semicon China	Shanghai, China	
March 18-20	electronica & ProductronicaChina 2008	Shanghai, China	
March 20	Display Material & Device Business Forum	Taipei, Taiwan	
March 24-25	Future of Television	Los Angeles, California	
March 26-28	Eye Tracking Research & Applications	Savannah, Georgia	
March 26-29	International Sign Expo	Orlando, Florida	
March 28-30	Sign Today	New Delhi, India	
March 31 - April 2	IPTV 2008	Berlin, Germany	
March 31 - April 3	Digital Signage 2008	San Francisco, California	
April 2008			
April 1	Lighting for Mood, Health, and Well-being	London, England	
April 1-3	Display 2008	Paris, France	

April 1-3	Foundation in Displays	Nottingham, England	DisplayMasters
April 5-10	CHI 2008	Florence, Italy	CHI 2008
April 7-11	Photonics Europe	Strasbourg, France	SPIE The International Society for Optical Engineering
April 7-11	MIPTV	Cannes, France	miptv
April 8-9	Printed Electronics Europe	Dresden, Germany	IDTechEx
April 9-10	AMOLED and Flexible Displays	Seoul, Korea	Displaybank
April 9-12	Global FPD Partners	Miyazaki, Japan	semi
April 10-11	RTT 3D Realtime Visualization Conference	Vienna, Austria	RTT
April 11-17	NAB 2008	Las Vegas, Nevada	NAB
April 12-13	Digital Cinema Summit	Las Vegas, Nevada	SMPTE
April 13-18	CEA 861/HDCP PlugFest	Milpitas, California	CEA
April 14-15	International Integrated Manufacturing by Printing Colloquia	Gregynog, Wales	
April 14-15	Inkjet Academy: Theory of Inkjet Technology / Manufacturing Process Symposium	Denver, Colorado	IMI
April 14-17	Hong Kong Electronics Fair Spring	Hong Kong, China	Hong Kong ELECTRONICS
April 14-18	EuroGraphics	Crete, Greece	EG
April 15	Mobile TV & Video Summit	Las Vegas, Nevada	iHollywoodForum
April 15-16	2nd Annual International Film Festival Summit Europe	London, England	IFFS
April 15-17	iSuppli European Briefing	Lisbon, Portugal	iSuppli Applied Market Intelligence
April 15-17	LED Packaging 2008	Penang, Malaysia	Intertech Pira
April 16	Broadband TV World	Las Vegas, Nevada	iHollywoodForum
April 16-17	Mobile & Interactive Displays Display Drivers and Interfacing Techniques	Stevenage, England	SID
April 16-17	KioskCom Self ServicExpo	Las Vegas, Nevada	KioskCom self servicexpo
April 16-18	FineTech Japan & Display 2008	Tokyo, Japan	FINETECH JAPAN
April 16-18	Inkjet Technology Supplier's Showcase	Denver, Colorado	IMI
April 17-18	2008 Taiwan FPD Conference	Taipei, Taiwan	DisplaySearch
April 21-23	Organic Photovoltaics	Philadelphia, Pennsylvania	Intertech Pira

April 22-24	Sign UK/Digital Signage Showcase	Birmingham, England	
April 25	Business Goes Green	New York, New York	
April 28-30	Innovative Lighting & Design	Dearborn, Michigan	
April 29 - May 1	Worship Facilities Conference & Expo	Indianapolis, Indiana	
April 30 - May 2	CEDIA Electronic Lifestyles Forum	Dallas, Texas	
May 2008			
May 4-7	UV and EB Curing for Electronics	Chicago, Illinois	
May 5-7	SEMICON Singapore	Singapore	
May 5-7	Smart Fabrics 2008	Charleston, South Carolina	
May 5-8	Digital Hollywood Spring	Los Angeles, California	
May 6-7	Introduction to Printing for Micro Manufacture	Swansea, Wales	
May 8-9	Plastic Electronics Workshop	Cardiff, Wales	
May 13-16	Symposium on Virtual and Augmented Reality	João Pessoa, Brazil	
May 14	Integrated Digital TV Conference	Taipei, Taiwan	
May 14	Digital Book 2008	New York, New York	
May 15-16	BLU & LED Seminar	Seoul, Korea	
May 15-18	SIIM 2008	Seattle, Washington	
May 18-23	SID International Symposium	Los Angeles, California	
May 19-21	International Symposium on Electronics and the Environment	San Francisco, California	
May 19-23	2008 Technology & Standards Forum	Nashville, Tennessee	
May 20-21	DisplaySearch China HDTV Conference	Guangzhou, China	
May 20-22	CeBIT Australia	Sydney, Australia	
May 20-23	Orbit-iEX	Zurich, Switzerland	
May 21-23	Asia Flat Panel Display Industry Expo	Guangzhou, China	
May 23	Shenzhen FPD Conference '08	Shenzhen, China	
May 25-27	International CES/Hometech	Dubai, UAE	

May 26-28	EuroVis 2008	Eindhoven, Netherlands	
May 26-30	Lightfair	Las Vegas, Nevada	
May 28	Digital Signage Conference	Chicago, Illinois	
May 28-30	Graphics Interface 2008	Windsor, Ontario	
May 28-30	3DTV Conference	Istanbul, Turkey	
May 27 - June 2	International OLED Summer School	Krutyn, Poland	
June 2008			
June 1-5	Nanotech 2008	Boston, Massachusetts	
June 2-3	Ambience 08	Boras, Sweden	
June 3-5	Dimension 3 Expo	Chalon sur Saône, France	
June 3-7	Computex 2008	Taipei, Taiwan	
June 4-5	EuroLED 2008	Birmingham, England	
June 5	High Def Expo	Chicago, Illinois	
June 6	Business Goes Green	San Jose, California	
June 9-13	European Conference on Color in Graphics, Imaging, and Vision	Terassa, Spain	
June 11-12	ITO & Touchscreen Panels	Seoul, Korea	
June 11-13	Display Taiwan 2008	Taipei, Taiwan	
June 11-13	Photonics Festival: OPTO Taiwan , SOLAR, LED Lighting, Optics	Taipei, Taiwan	
June 12-14	Digital Downtown	New York, New York	
June 14-20	InfoComm '08	Las Vegas, Nevada	
June 16-17	Projection Summit	Las Vegas, Nevada	
June 16-18	International Conference on Organic Electronics	Eindhoven, Netherlands	
June 17-18	Photovoltaics US	Denver, Colorado	
June 18-20	Photovoltaics Summit	San Diego, California	
June 19	Communications Goes Green	Las Vegas, Nevada	
June 23-26	Cinema Expo	Rotterdam, Netherlands	

June 24-26	CEDIA Expo UK	London, England	
June 24-26	Plastic Electronics Asia	Seoul, Korea	
June 24-27	FPD Expo/LED Expo	Seoul, Korea	
June 25	Bistable Displays and Applications	Bristol, England	
June 25-27	Industrial Virtual Reality Expo & Conference	Tokyo, Japan	
June 25-27	Electronic Materials Conference	Santa Barbara, California	
July 26-29	Taitronics Bangkok 2008	Bangkok, Thailand	
June 27-29	Flat Panel Display Technology and Equipment Exposition	Beijing, China	
June 27-29	International LED Exposition	Beijing, China	
July 2008			
July 2-4	International Workshop on Active Matrix FPD & Devices	Tokyo, Japan	
July 3-4	Korea Display Conference 2008	Ilsan, Korea	
July 3-6	Imaging Expo China	Shanghai, China	
July 7-9	Eurographics/SIGGRAPH Symposium on Computer Animation	Dublin, Ireland	
July 8-11	Information Visualization	London, England	
July 9-14	National Stereoscopic Association 2008 Convention	Grand Rapids, Michigan	
July 10-11	Symposium on Flexible Organic Electronics	Halkidiki, Greece	
July 10-13	SINOCES	Qingdao, China	
July 15-17	Semicon West 2008	San Francisco, California	
July 30-31	DisplaySearch Japan Forum	Tokyo Japan	
July 30 - August 1	CEDIA Expo Asia Pacific	Sydney, Australia	
August 2008			
August 9-10	Web3D 2008 Symposium	Los Angeles, California	
August 10-14	Optics & Photonics	San Diego, California	
August 11-16	SIGGRAPH 2008	Los Angeles, California	
August 19-22	Display Metrology Short Course	Boulder, Colorado	

August 24-26	Australasian Gaming Expo	Sydney, Australia	
August 29 - September 3	IFA 2008	Berlin, Germany	
September 2008			
September 2-5	electronicIndia	Bangalore, India	
September 3-4	PDP Tutorial	Seoul, Korea	
September 3-7	CEDIA Expo 2008	Denver, Colorado	
September 5-6	International Workshop on Image Media Quality and its Applications	Kyoto, Japan	
September 7-10	PLASA '08	London, England	
September 9-11	Semicon Taiwan, 2008	Taipei, Taiwan	
September 10-12	InterOpto '08	Tokyo, Japan	
September 11-13	Taitronics India 2008	Chennai, India	
September 11-16	IBC 2008	Amsterdam, Netherlands	
September 14-16	Inter-Society Color Council Annual Meeting	Baltimore, Maryland	
September 15-18	Foundation in Displays	Dundee, Scotland	
September 16-17	Organic Electronics for Displays	London, England	
September 23-24	Mobile Displays 2008	San Diego, California	
September 23-28	Photokina	Köln, Germany	
September 29 - October 1	Organic Electronics Conference	Frankfurt, Germany	
September 29 - October 1	3D Biz-Ex	Universal City, California	
September 29 - October 1	LEDs 2008	San Diego, California	
September 29 - October 2	EOS 2008	Paris, France	
September 30 - October 4	CEATAC Japan 2008	Tokyo, Japan	
October 2008			
October 1-2	KioskCom Europe	London, England	
October 1-3	Display 2008	Moscow, Russia	
October 2-3	Tabletops and Interactive Surfaces 2008	Amsterdam, Netherlands	

October 7-8	Taiwan FPD Conference '08	Taipei, Taiwan	Displaybank
October 7-9	SEMICON Europa 2008	Stuttgart, Germany	semi
October 7-9	Printed Electronics Asia	Tokyo, Japan	IDTechEx
October 7-11	Taipei Int'l Electronics Autumn Show	Taipei, Taiwan	
October 7-12	CeBIT Bilisim EurAsia	Istanbul, Turkey	CeBIT
October 9-10	2008 FPD Market Analysis & 2009 Market Outlook	Seoul, Korea	Displaybank
October 13-16	Hong Kong Electronics Fair Autumn	Hong Kong, China	Hong Kong ELECTRONICS
October 13-16	Showeast	Orlando, Florida	
October 13-17	IMID 2008	Ilsan, Korea	KIDS SID
October 13-17	IMID/IMDC/Asia Display 2008	Ilsan, Korea	SID
October 14-17	Korea Electronics Show	Seoul, Korea	KEA
October 15-16	Photonex 2008	Stoneleigh Park, England	PHOTONEX
October 15-19	CEA Industry Forum	Las Vegas, Nevada	CEA
October 16-17	SID Vehicles and Photons	Dearborn, Michigan	SID
October 15-18	SMAU 2008	Milan, Italy	smau
October 19-22	Symposium on User Interface Software and Technology	Monterrey, California	
October 19-23	GITEX 2008	Dubai, UAE	GITEX
October 20-23	SATIS 2008	Paris, France	SATIS
October 20-24	Technology & Standards Fall Forum	Las Vegas, Nevada	CEA
October 27-30	CeBIT Asia	Shanghai, China	CeBIT
October 27-30	Digital Hollywood Fall	Los Angeles, California	Digital Hollywood
October 28-29	International Conference on Organic Materials Technology	Tokyo, Japan	
October 28-30	SMPTE Technical Conference & Exhibition	Los Angeles, California	SMPTE
October 29-30	Plastic Electronics	Berlin, Germany	Plastic Electronics
October 29-30	High Def Expo	Burbank, California	HD
October 29-31	FPD International	Yokohama, Japan	FPD International
October 30 - November 1	Integrated Systems Russia	Moscow, Russia	infoComm

November 2008			
November 3-6	IDRC	Orlando, Florida	
November 4-5	DisplayForum	Dusseldorf, Germany	
November 4-6	Digital Video Expo East	Los Angeles, California	
November 4-7	EHX Fall 2008	Long Beach, California	
November 5-6	OLED Seminar	Seoul, Korea	
November 10-15	Color Imaging Conference 2008	Portland, Oregon	
November 11-13	Crystal Valley Conference	Cheonan, Korea	
November 11-14	electronica	Munich, Germany	
November 11-16	SIMO 2008	Madrid, Spain	
November 13-14	Future of Television	New York, New York	
November 18-20	Global Gaming Expo	Las Vegas, Nevada	
November 18-21	Display Metrology Short Course	Boulder, Colorado	
November 19-21	InfoComm Asia	Hong Kong, China	
November 30 - December 5	RSNA 2008	Chicago, Illinois	
December 2008			
December 2-3	Forum 'be-flexible'	Munich, Germany	
December 3-4	Display Industry Equipment Forum	Seoul, Korea	
December 3-4	Printed Electronics US	San Jose, California	
December 3-5	International Display Workshops	Niigata, Japan	
December 3-5	SEMICON Japan	Tokyo, Japan	
December 9-10	Hollywood Goes Green	Los Angeles, California	
December 9-11	CineAsia	Macau, China	
December 10-13	SIGGRAPH Asia	Singapore	

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