SiBEAM™
wireless beyond boundaries

# Technology Transfer In Start-ups
## Why Good Tech Is Barely Half the Battle

John LeMoncheck
President & CEO

# Solutions In Search of A Problem

- Technology advances, in and of themselves, are not sufficient to create a successful business
- Xerox PARC
  - Revered for its research
  - Missed most opportunities
- Interval Research
  - 7 years of pure research
  - “Just did cool stuff”
  - Shut down after $100M
- “This is a science project” is a VC epithet for unfundable

# But Problems Need Appropriate Solutions


Because pets can't drive!

amazon.com

Every product from A to Z

# Research AND Development

- Enabling technologies and ideas without focus critical for breakthroughs
- Take the innovation and find the appropriate application
- Vitamins vs. painkillers

# What Makes a Good Fit?

- At least a 10x price – performance advantage
  - Moore's Law will catch you
- Huge market for at least a 20x return
  - Normal metric is 10x but it'll cost you 2x what you expect
- Deep customer focus and understanding
- Luck and timing are an undeniable factor

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# SiBEAM wireless beyond boundaries

# Breakthrough in CMOS Modeling

- Researchers at BWRC looking for the next advance in high-speed CMOS design

**Bob Brodersen, Ph.D.**
***Chairman***
- Co-founder & Advisory Board, Atheros
- Founder and Co-director, BWRC
- IEEE Fellow
- Professor, University of California, Berkeley

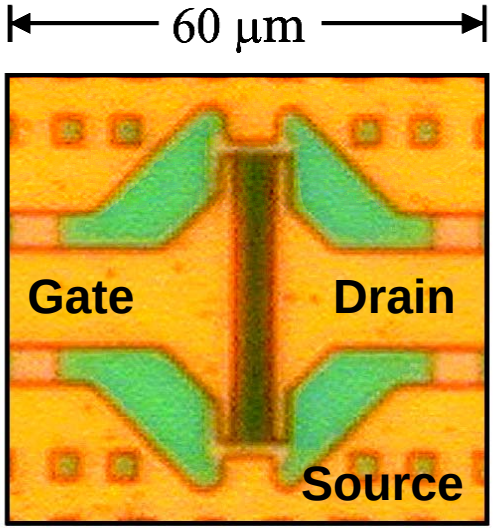
**Chinh Doan**
***Vice President, RF & Analog Design, Co-Founder***
- Engineer,Teradyne and Agilent Technologies -
- Industry leading doctoral research on modeling, test and amplifier design of 60GHz in CMOS

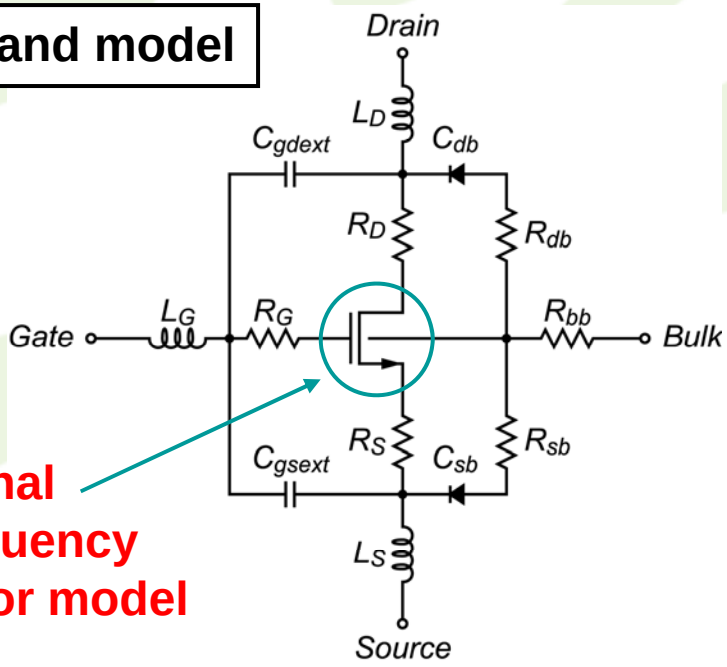
**Sohrab Emami**
***Chief Architect, Co-Founder***
- Industry leading research on design and modeling of CMOS transceiver circuits
- Co-founder, KARA-Systems, Inc.

# Accurate Modeling Enables Microwave CMOS

- Design and modeling approach predicts measured results extremely well to >100 GHz
- Accurate models enable designs that exploit the full capabilities of the technology
- Fully-automated model extraction

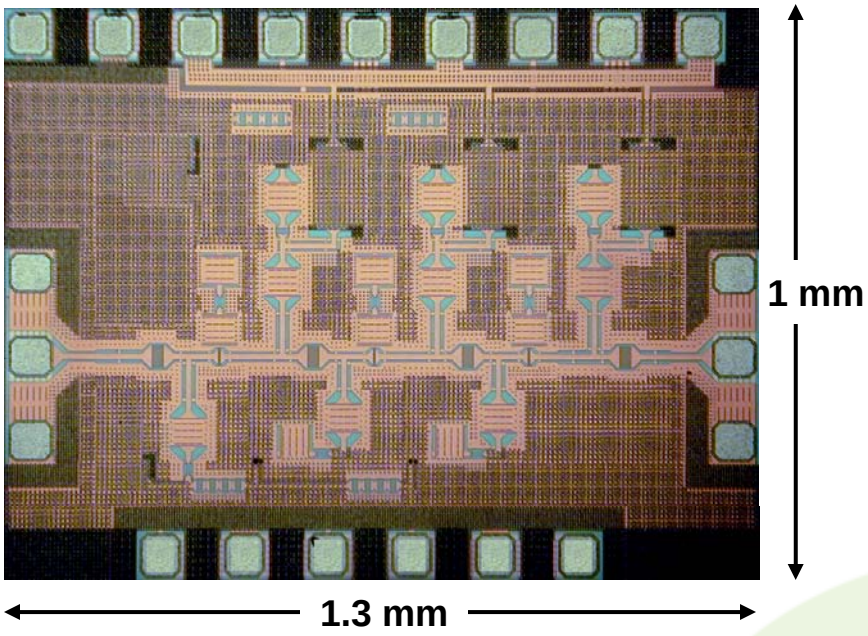
**mm-Wave transistor layout and model**

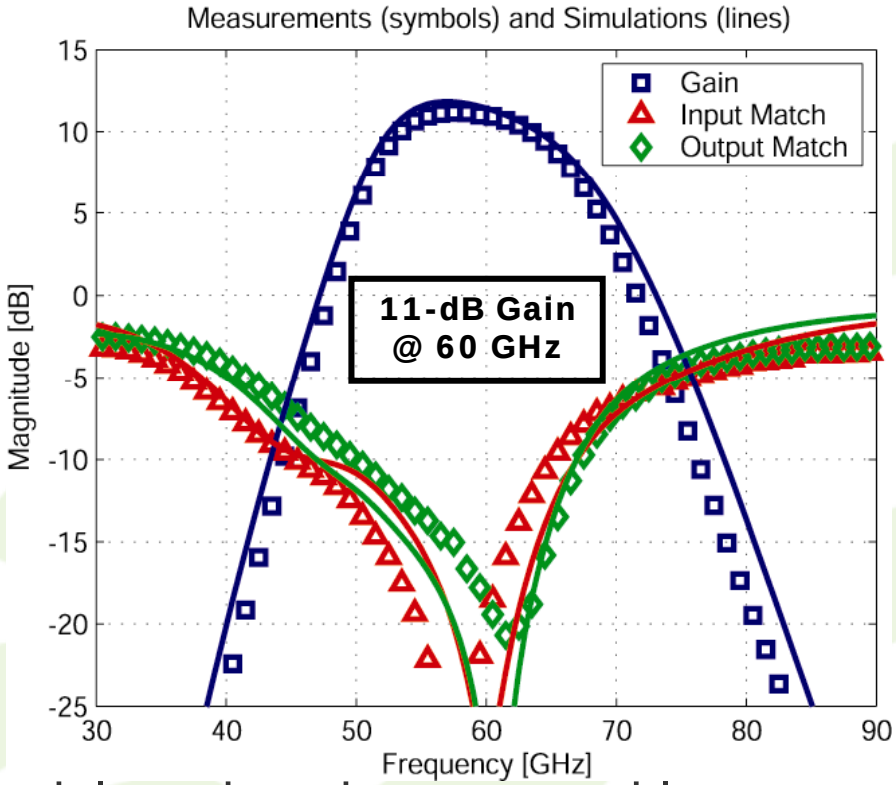



**Traditional low-frequency transistor model**

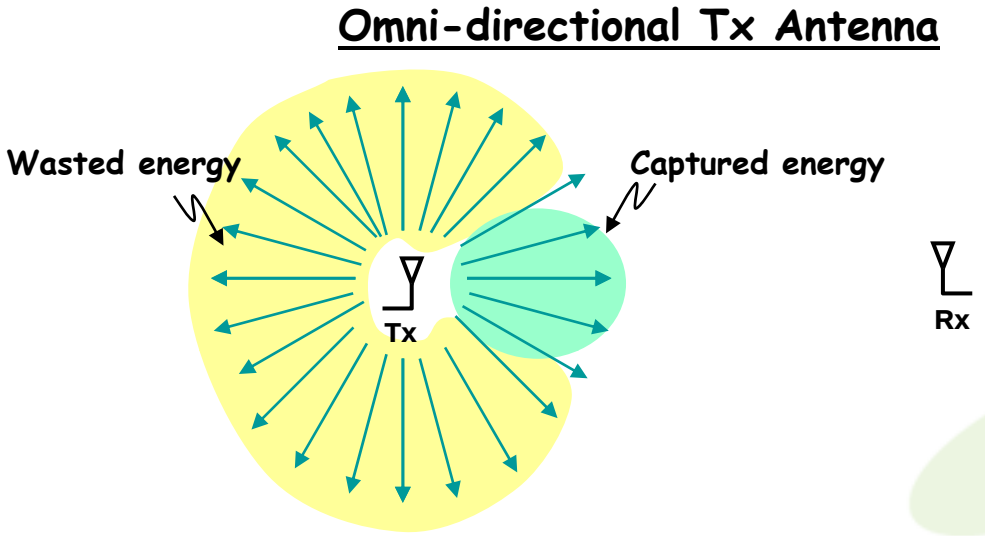
# 60GHz CMOS Amplifiers



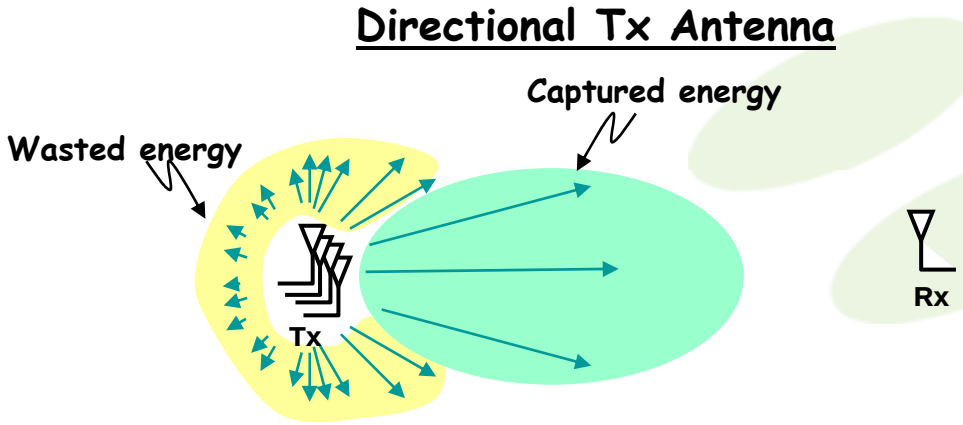




- We have developed a design methodology that gives repeatable results for microwave CMOS design (matches even better than conventional low GHz)

# Beamforming and Antenna Gain




- Omni-directional antenna inefficient
  - Energy transmitted in unwanted directions




- Antenna array forms narrow, steerable beam
  - Concentrate Tx power in "proper direction"
  - Increases $G_{TX}$

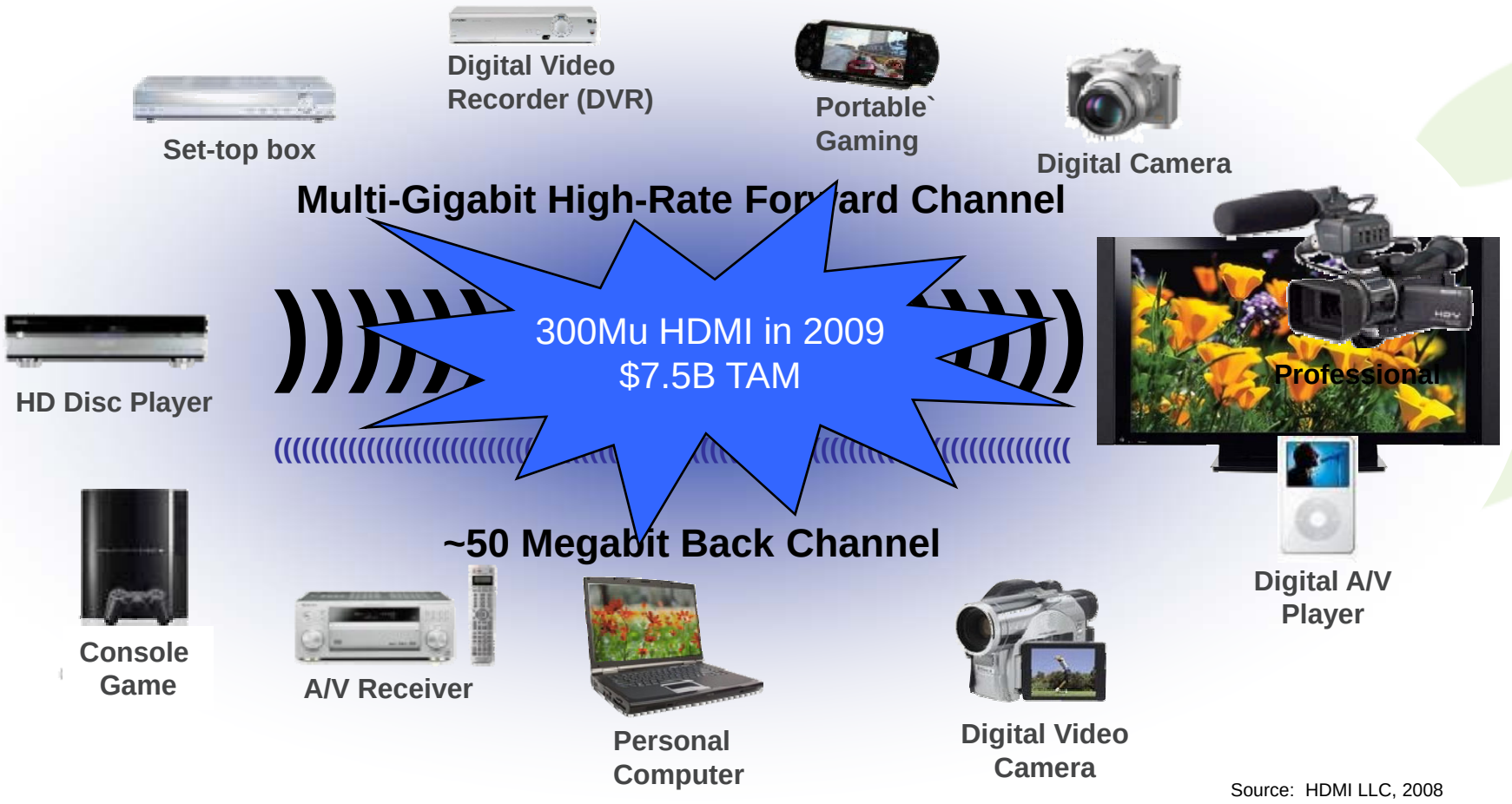
# So What Application to Go After?

- Automotive Radar
- Data transfer
- Networking
- Security Imaging

- All promising, but each seemed like a “vitamin” solution

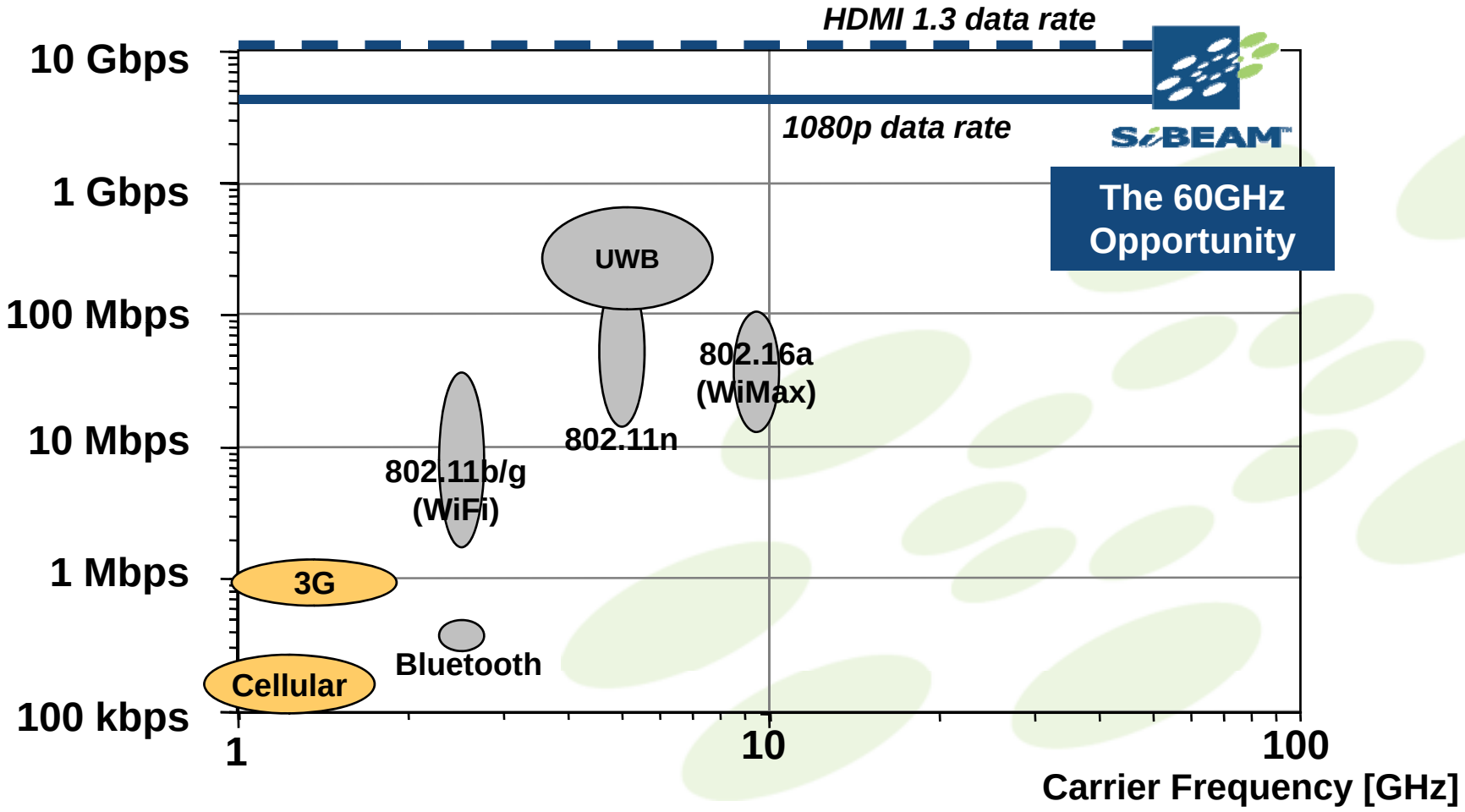
# The Vision for the Wireless Living Room

# In-Room Media Connectivity




Source: HDMI LLC, 2008

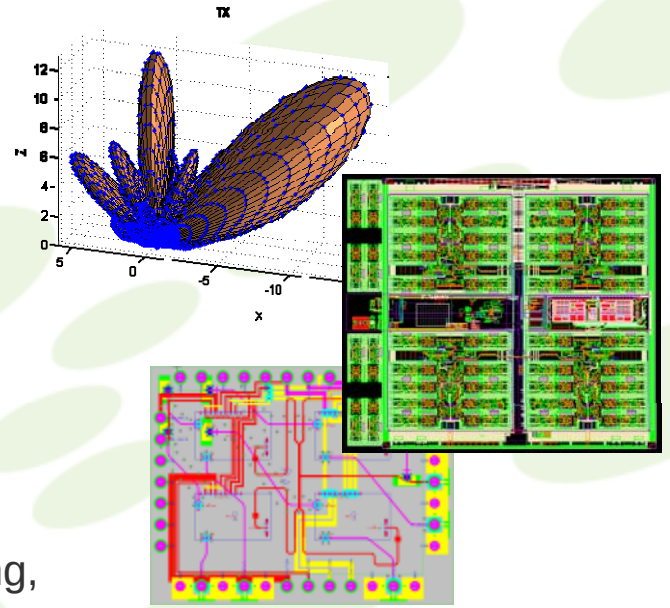
# Wireless Communications Landscape




***60 GHz band available world-wide***

# INNOVATION Wireless & Audio/Video

- SiBEAM firsts:
  - CMOS modeling at millimeter wave frequencies
  - Breakthrough 60GHz RF chips in standard CMOS
  - Integrated multi-element antenna technology
  - OmniLink60™ technology for non-line-of-sight A/V applications in 60GHz band
- Rich Patent Portfolio
  - Seminal beam steering system patent
  - Broad range including algorithms, circuits, packaging, manufacturing, test



# OMNILINK60 Enabling Wireless Video Area Networks

# Technology & Market Established… Now What?

- 10x price – performance over existing technologies
  - 20x faster than “next generation” wireless at CMOS prices
- Huge market and potential for return
  - 10% penetration into >40” TV’s = >$250M revenue
  - In a normal market ~$1B value
- “Pain killer” customer experience
  - Uncompressed video has no wireless delivery system
- Leading technologists and experienced CE team
- But how to go to market?

# Communications “Chicken & Egg”

- You need “talkers” and “listeners” for communications to happen
- Consumers rarely buy their sources and sinks from the same vendor
  - Sources:  PS3, Xbox, DIRECTV, Comcast, PC vendors
  - Sinks:  Samsung-Sony-Panasonic TVs, Denon AV Rx, etc.
  - Virtual cable market (adapter pairs) very small and defeats the purpose
- Other wireless technology plus compression coming on strong
- Standard needed to get market moving and delay existing technologies

# Standards Strategy

- Creating a standard can enable multiple vendors to all want your technology
  - Opens the door to competition
  - Must have a long term advantage outside the standard
- Standard needed to get market moving and delay existing technologies
  - Other wireless technology plus compression coming on strong

# Highest Quality A/V Transmission

## WirelessHD delivers full HD without visual distortions from lossy techniques

WirelessHD

**Other wireless A/V:**

- Quality degradation
- Expensive codec
- Latency
- No uniform standard

Lossy, Low-bandwidth Wireless

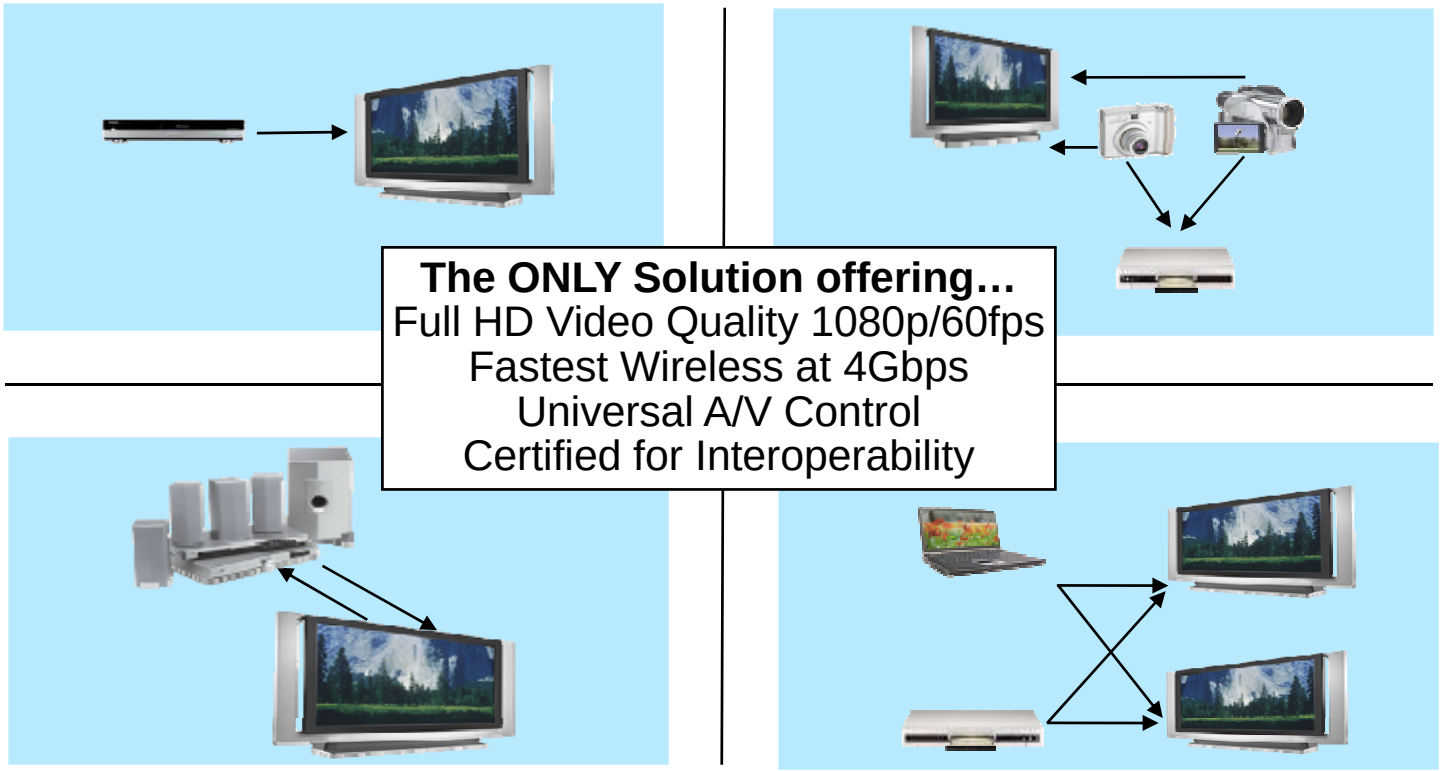
# Standards Landscape Fraught with Problems

- IEEE highly political and “one person – one vote” structured



- In 2005, formed subsidiary WirelessHD, LLC
  - Focus on ***industry*** standard for wireless video area networks

# WirelessHD. Pure Wireless. Perfect Image.



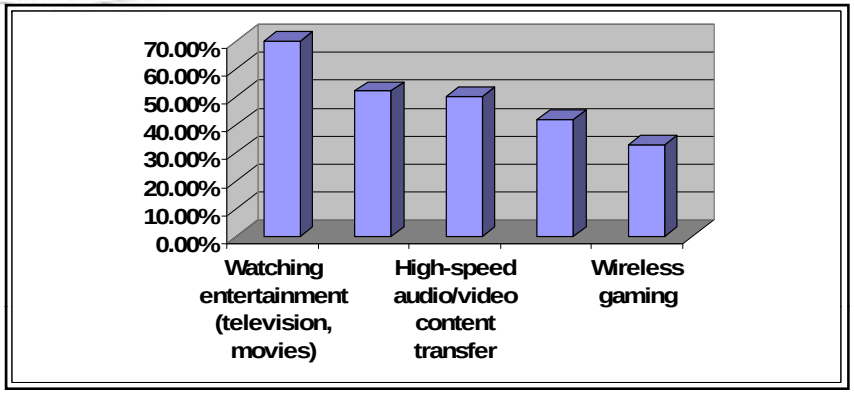
# WirelessHD Consortium, Promoters & Adopters

## Visit www.WirelessHD.org to Become an Adopter

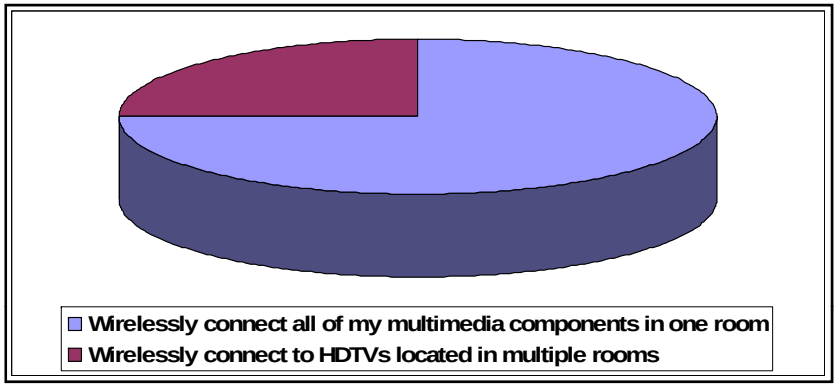
- Formed in 2006, leading CE companies developed spec for lossless, uncompressed 1080p/60Hz A/V
- WirelessHD 1.0 completed Dec '07; Compliance Test Spec 1.0 and Authorized Test Center Dec '08
- Interoperable product demonstrations in Dec '09; WiHD compliant products in 1H09

# Consumer Markets Want WirelessHD Connectivity

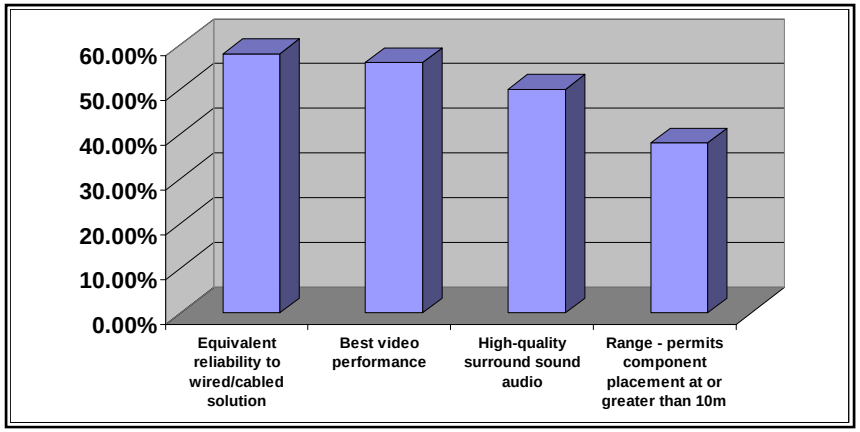
How do consumers want to use HD?



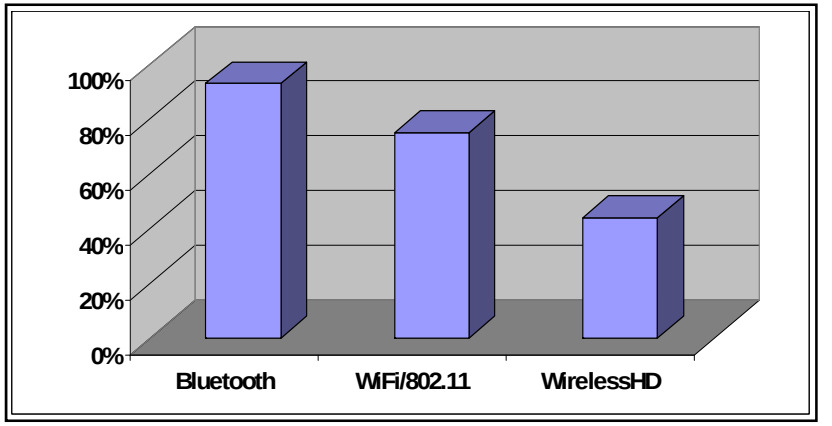

Where do consumers want to use wireless?




Important features for wireless connections?




WirelessHD awareness?



# Building Market Momentum
## CES 2008 Panasonic Keynote

- Sakamoto-san “cuts the cord”
- Commits to WirelessHD by SiBEAM in 2009
- Announces product at CES 2009


# Building Market Momentum
## IFA 2008 Consumer Electronics Trade Show

**Samsung Introduces "Seamless Experience" at IFA 2008**

***Shares Ambitious Plans to Bridge "Digital Divide,"***

***To help Consumers Enjoy Digital Benefits Anytime, Anywhere***

**Berlin, Germany, August 29, 2008**– Samsung Electronics Co., Ltd., a global leader in digital media and digital convergence technologies, today unveiled ambitious plans to take the lead in developing products and technologies that help consumers from all walks of life be part of today's digital benefits.

- Samsung CEO shows WirelessHD as part of "Seamless Experience" during keynote
- Panasonic and Toshiba also demonstrate in their booths on the show floor

# SiBEAM's WirelessHD 1.0 Products

- 1080p HD A/V solutions
- Transmitter chipset (Source)
  - SB9120 Network Processor
  - SB9110 RF Transceiver
- Receiver chipset (Sink)
  - SB9121 Network Processor
  - SB9111 RF Transceiver
- WirelessHD Development Kit
  - SK9110TXRX

- ***Announced mass production at CES 2009***

# Building Market Momentum

## WirelessHD Products Announced at CES 2009


LG LH85 and LHX

Panasonic P54Z1


Toshiba Adapters


Gefen Adapters


Module Providers Abocom, Murata, & LG Innotech

# Panasonic Launches in Japan – Feb 3, 2009

- 46”, 50”, and 54” PDP TVs that are 24.7mm thick
- WirelessHD module
- Available April 20


Tech-On!

デジタル家電

**Wireless HDで1080p映像を無線伝送，パナソニックが厚さ24.7mmのPDPテレビを発表**

2009/02/03 21:06

パナソニックは，PDPテレビ/液晶テレビ「VIERA」の新製品13機種を発表した（図1，図2）。中でも厚さ24.7mmのPDPテレビは「Wireless HD」による1080pのHDTV映像の無線伝送機能を備えるなど，「壁張り」や「壁寄せ」などレイアウト・フリーをうたう。

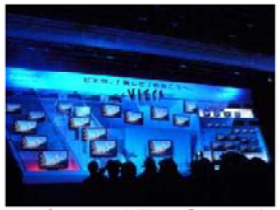


図1 パナソニックの薄型テレビ「VIERA」の新製品。会場では発表済みの「C」シリーズと「X」シリーズも展示されていた

**チューナー分離型は厚さが約1インチ**

最上位機種となるZシリーズはPDPテレビのみを展開。画面寸法は54型，50型，46型の3種類。最厚部24.7mm（約1インチ）と薄さをウリにする（図3，ただし46型は最厚部49mm）。「超薄型」をうたう他社の液晶テレビと同様に，表示部（モニター部）とチューナー部を分離した構成を採用した（Tech-On!の関連記事1，Tech-On!の関連記事2）。表示部とチューナー部はHDMIケーブルで接続する。オプションとして，無線伝送ユニットを提供する（図4，図5）。伝送規格には，パナソニックやソニー，米SiBEAM，Inc.などが策定を進めるWireless HDを採用しており，1080pのHDTV映像を60GHz帯のミリ波を使って非圧縮で伝送できる。なお，Wireless HDを採用したデジタル機器は「世界初」（パナソニック）となる。

CNET Japan

**パナソニック、プラズマで薄さ24.7mmのZシリーズ含む新「VIERA」をラインアップ**

加納恵（編集部）

2009/02/03 19:24

北京会場にはCMキャラクターの小雪さんと設楽はるかさんも登場した

プラズマテレビには、新開発の「ネオ・プラズマパネル」を搭載し、動画解像度1080本、コントラスト比4万対1の高精細映像を実現するという。一方液晶テレビには半光沢パネルを採用した新「IPSαパネル」を採用し、鮮明な映像を視聴できるとのことだ。各機種の特徴は下記のとおり。

Zシリーズは、プラズマテレビながら奥行き24.7mmを実現したスリムボディモデル。46型、50型、54型の3サイズをラインアップする。薄型パネル部とチューナー部をセパレート構成とし、別売のフルハイビジョンワイヤレスユニット「TU-WH1J」（店頭想定価格：6万円）を利用すれば、「WiHD」（Wireless HD）によるワイヤレス接続が可能。パナソニックによるWiHD規格を採用したプラズマテレビは世界初とのこと。

# Building Market Momentum
## Telling Consumers About WirelessHD

# Building Market Momentum
## Being Ready For Your Luck

- Various announcements of super thin panels
  - Light enough to install yourself
  - Separate tuner / connectivity box
- Lack of processing in the panel demands uncompressed connection

# WirelessHD Is Only The Beginning

- **IEEE 802.15.3c**
  - 60GHz for wireless Personal Area Networking (PAN)
  - Short range, multi-gigabit “Sync and Go” applications
  - SiBEAM PHY integral to spec
- **IEEE 802.11ad**
  - 60GHz for Gigabit wireless LAN
  - Project Authorization Request approved last month

**Wireless PAN**
**$5.25B Market**

1.5B nodes x $3.50/node in 2010
Wireless USB, 1394, high rate Bluetooth
(WiMedia/In-Stat/MDR, 01/06)

**Wireless LAN**
**$1.36B Market**

170M nodes x $8/node in 2010
(In-Stat/MDR, 8/04)

# Moving From The Lab to the Shelf

- Right technology for the problem
- Good problem to solve
- Team and customer partnership
- Nice sprinkling of opportunity

# Thank You!

# Agenda

- Posing the question
  - Technology not good enough by itself (example) – Slide 1
  - Marketing idea not good enough (appropriate tech needed pets.com) – slide 2
  - “This is a science project” is recognized as not a good comment in the business world – slide 3 (picture of a lab)
- Hallmarks of a good technology – market fit – Slide 4 animated entrances
  - Order of magnitude performance-value over existing solutions
    - Moore’s law will catch you
  - Huge market – potential for at least 20x return
    - Multiple markets even better
    - Danger of defocusing
  - Market dynamics well understood
  - Luck and timing is undeniably a factor
    - Chinese proverb
    - Luck is where preparation and opportunity meet – be ready for your chance