

MHL[®] Technology

Chandlee Harrell

September 25, 2012



HD Connectivity That Just Works

Agenda

- ◆ MHL Market Update
- ◆ Overview of the MHL Standard
- ◆ MHL Specification
- ◆ Summary

- ◆ Demonstration



MHL Market Update

The Transformation to Mobile is Everywhere



Over 2.5 billion mobile devices by 2015

Phones . Tablets . Cameras

*>2.5 billion mobile devices ship in 2015
Source: In-Stat November 2011*

Mobile Video Market Trends



- ◆ VGA to 1080p
- ◆ Single/dual- to quad-core GHz CPUs
 - ◆ 3G to 4G broadband
 - ◆ Casual to serious gaming
- ◆ **Content engine in the palm of your hand**

Mobile Device Usage Constraints



Screen Size



Battery Life



Interactivity

Expanding Mobile Device Usage



Home
Entertainment



Gaming



Productivity

Automotive



Connectivity to large displays is central to consumer experience

Need for Optimal Mobile Connectivity



HD audio and video

Interactivity, without video latency

Mobile form factor

Excellent battery operation

Easy to design



MHL Ecosystem



50 Million Products Shipped in **2011**
200 Million Total by end of **2012**

MHL Adopters

3

3M Company
www.3m.com
Global Innovation
A
Accell Corporation
www.accelcables.com
(Affiliate of BIZLINK TECHNOLOGY)
Accupix, Inc
www.accupix.com
Multimedia Devices
Acer Incorporated
www.acer.com
Computer technology and electronics corporation
Actions Semiconductor Co., Ltd
www.actions-semi.com
Fabless semiconductor company providing SOC products and solutions
Adapteck Technology Co. Ltd.
www.adapteck.com.tw
Adapter supplier
Advanced Connectek Inc (ACON)
www.acon.com
Cable and Accessories Manufacturer
Aiptek International, Inc
www.aiptek.com.tw
Portable Device Manufacturer
Allion Test Labs, Inc
www.allion.com
Test and validation solutions
Amphenol Assemble Tech
www.assembletech.com
Provider of custom cables and contract manufacturing services
Analog Devices, Inc
www.analog.com
Supplier of high performance analog front-end devices in CDD
Astrodesign, Inc.
www.astrodesign.co.jp
Provider of digital video products
Asustek Computer, Inc
tw.asus.com
PC Manufacturer
Audio Partnership PLC
www.audiopartnership.com
Hi-Fi Equipment Manufacturer
B
Belkin International
www.belkin.com
CE Accessories Manufacturer
Best Buy China, Ltd
www.bb.com
A subsidiary of Best Buy Corporation, a leading multi-channel global
BizLink Technology, Inc.
www.bizlinktech.com
Cable Assemblies and Wiring Harnesses
BMW
www.bmw.com
Automotive
C
C.S.L Wire & Plug Company
www.csl-cable.com
Cable Manufacturer
CE LINK LIMITED
www.ce-link.com
Cable Manufacturer
Cheng Uei Precision Industry Co., Ltd (Foxlink Group)
www.foxlink.com
Designer and manufacturer of connectors and cable assemblies
ClamCase, LLC
www.clamcase.com
Mobile, CE and PC Accessories Manufacturer
Compal Electronics Inc.
www.compal.com
Electronics manufacturer of notebook computers and monitors
D
DAEIN TECH Inc
www.daointech.com
Automotive
Daeshin Information & Technology Co., Ltd.
www.daeshin-it.net
Mobile, consumer electronics and PC accessories manufacturer
D&M Holdings Inc.
www.dm-holdings.com
Manufacturer of audio and video products
David Electronics Co., Ltd. (DAEC)
www.daec.com.tw
Manufacturer of Cables and Connectors
Datapower Development Ltd.
Cable Manufacturer
Dell Inc.
www.dell.com







PC Manufacturer
Desay A&V Science And Technology Co.,Ltd
www.desay.com
DVD or Blu-ray Manufacturer
Dolby Laboratories
www.dolby.com
CE Manufacturer
Dongguan city Lontion Electronic Co.,Ltd
www.dg-lontion.com.cn
Cable Manufacturer
Dong Guan Primax Electronic & Telecommunication Products, Ltd.
www.primax.com.tw
Global supplier in consumer and business electronics
Dongguan Kechenda Electronics Technology Co., Ltd.
en.kechenda.com/profile.html
Cable and Accessories Manufacturer
E
Elka International Ltd.
www.elka.com
Cable Manufacturer
Ever Win International Corp.
www.everwin.com
Mobile communications and CE accessories solutions provider
Explore Microelectronics, Inc.
www.epmi.com.tw
Fabless company developing high-speed interface ICs
F
Fairchild Semiconductor
www.fairchildsemi.com
Delivers semiconductor solutions for power and mobile designs
Foxconn Technology Group
www.foxconn.com
Contract manufacturing and component provider in 3C industries
Freeport Resources Enterprises Corp.
www.freeport.com
Connector Manufacturer
Fujitsu Limited
www.fujitsu.com/global
ICT Solutions Provider
Fujitsu Technology Services
www.fujitsu.com/fts
A subsidiary of Fujitsu Limited
Funai Electric Co. Ltd.
www.funai.jp
Consumer electronic products manufacturer
Fusion Garage PTE, Ltd
www.fusiongarage.com
Mobile Handset Manufacturer
Future Technology (Shenzhen) Co., Ltd
caoke.net
Connector Manufacturer
G
Gionee Communication Equipment Co., Ltd Shenzhen
www.gionee.com
Mobile Handset Manufacturer
Glory Mark Electronics Ltd.
www.glorymark.com.tw
Cable Manufacturer
Goodway Technology Co., Ltd
www.goodway.com.tw
Accessories Manufacturer
Gopod Group Limited
www.Gopod.cc
Mobile Accessories Manufacturer
GuangDong OPPO Mobile Telecommunications Corp., Ltd
www.oppo.com
Mobile Handset Manufacturer
H
Hama GmbH & Co. KG
www.hama.de
Accessories Manufacturer
Handong Lnc Co, Ltd. (HDLNC)
www.hdlnc.com
Smartphone Software Solution
Hank Electronics Ltd
www.hank-tech.com
Cable Manufacturer
HEISEI Electronics Co., Ltd.
www.heisei.com.tw
Systems and Media Specialist
Himax Technologies Limited
www.himax.com.tw
Fabless semiconductor solution provider
Hisense Group
www.hisense.com
CE Manufacturer
Hisetec Electronic (Dongguan) Co., Ltd
www.hisetec.com
Cable Manufacturer

Hitachi America, Ltd
www.hitachi.com
DTV Manufacturer
HL Technology Group Limited
www.hong-lin.com.cn
Cable Manufacturer
Hosiden Corporation
www.hosiden.com
Manufactures and sells electronic components
Hotron
www.hotron.com.cn
Cable Manufacturer
HTC Corporation
www.htc.com
Handheld wireless telecommunications devices
Huawei
www.huawei.com/en
ICT Solutions Provider
Huizhou Shenghua Industry Co., Ltd.
www.tcl.com
Cable Manufacturer
Hyundai Motor Company
www.hyundai.com
Automotive
I
Innotech Corporation
www.innotech.co.jp
Semiconductor Trading Company
ITeTech Inc.
www.ite.com.tw
Semiconductor Manufacturer
I-Tech Korea
www.i-techkorea.com
CE Manufacturer
J
Japan Aviation Electronics Industry, Limited (JAE)
www.jae.co.jp
Connector Manufacturer
Jiangxi Ship Electronics Co., Ltd
www.shipgroup.net
Cable Manufacturer
Johnson Component and Equipment Co., Ltd.
www.jcecable.com
Cable Manufacturer
JVC Kenwood Corp
www.jvckenwood.co.jp
Consumer Electronics Manufacturer
K
KYOCERA Corporation
www.kyocera.co.jp
Mobile Handset Manufacturer
L
Lenovo
www.lenovo.com
PC manufacturer
LG Electronics
www.lg.com
Consumer electronics and mobile communications
Lontium Semiconductor Corporation
www.lontiumsemi.com
IP Solution Provider
Luxshare-ICT Co., Ltd
www.luxshare-ict.com
Cable Manufacturer
M
M.02 Communication Co., Ltd
mo2.co.kr
Mobile Device Solutions Provider
Master Hill Electric Wire & Cable Co., Ltd.
www.maxcable.com
Develops and Produces Wire and Cable Products
Maxim Integrated Products Inc
www.maxim-ic.com
Analog and Mixed-Signal Semiconductor Company
Mediatek
www.mediatek.com
Fabless Semiconductor Company
Meizu Technology Co., Ltd
www.meizu.com
Mobile Handset Manufacturer
MStar
www.mstarsemi.com
ASICs for consumer and communication products
Murata Manufacturing Co., Ltd.
www.murata.com
Provider of core electronics for mobile phones
N
National Instruments Denmark
www.ni.com
Test Equipment Manufacturer

NEC CASIO Mobile Communications, Ltd
www.nec-casio-mobile.co.jp/
Mobile Handset Manufacturer
Niketech Electronic Corporation
www.niketech.com.tw
Provider of connectors for the electronics industry
Ningbo Hentek Imp & Exp Co.,Ltd
www.hentek.cn
Cable Manufacturer
Norel Systems Ltd.
www.norelsys.com
Semiconductor Manufacturer
Novatek Microelectronics Corporation
www.novatek.com.tw
Fabless chip design company specializing in display
O
ON Semiconductor
www.onsemi.com
Supplier of high performance silicon solutions
Onkyo
www.onkyo.com
CE Manufacturer
P
Pantech Co., Ltd.
www.pantechusa.com
Mobile Phone Manufacturer
Parade Technologies, Inc.
www.paradetech.com
Develops and supplies advanced and cost-effective
Pioneer
www.pioneer.jp
CE Manufacturer
PNY Technologies, Inc
www.PNY.com
Cable Manufacturer
Q
Qualcomm Inc.
www.qualcomm.com
Fabless Semiconductor & Wireless Chipset
R
Realtek Semiconductor Corp.
www.realtek.com.tw
IC Design
Renesas Electronics Corporation
www.japan.renesas.com
Semiconductor Solutions Supplier
ROHM Co. Ltd.
www.rohm.co.jp/
Semiconductor manufacturer
Roku, Inc
www.roku.com
Entertainment
S
Seiko Epson Corporation
www.epson.com
Printer and Projector Manufacturer
SeongJi Industrial Co., Ltd
www.seongji.kr
Cable Manufacturer
Sharp Corporation
www.sharp.co.jp
DTV Manufacturer
Shenzhen Comlink Electronics Co., Ltd.
www.chinacomlink.com
Cable Manufacturer
SHENZHEN D&S INDUSTRIES LIMITED
www.dnscable.com
Mobile Accessories Manufacturer
ShenZhen Tronixin Electronics Co., Ltd.
www.tronixin.com
Cable Manufacturer
Shenzhen Xian Ying Electronic Co., Ltd
www.hkylink.com
Cable and Accessory Manufacturer
Silicon Integrated Systems Corp.
www.sis.com
CE Manufacturer
Sky Tech Worldwide, Inc
www.skytech-ww.com
Cable Manufacturer
SMARTphy
smartphy.com
Semiconductor Manufacturer
SMK Corporation
www.smk.co.jp
Accessories Manufacturer
Soundmax Electronics Limited
soundmax.manufacturer.globalsources.com
Automobile Entertainment System Manufacturer

Space Shuttle Hi-Tech Co., Ltd.
www.spaces.com.tw
Producer of 3C and communication cables
Standard Microsystems Corporation (SMSC)
www.smsc.com
Global supplier of semiconductor solutions that distribute
Sumitomo Electric Industries, Ltd.
global-sei.com
Designs, manufactures and sells cable and components
Sunplus Technology Co., Ltd.
www.sunplus.com
Provider of multimedia IC solutions
Sure-Fire Electrical Corporation
www.sure-fire.com.tw
Global OEM/ODM supplier of cables, connectors and devices
Synopsys
www.synopsys.com
Provider of electronic design automation (EDA) software
SZ Telstar Co., Ltd
www.telstar.net.cn
CE Manufacturer
T
T.E. Connectivity
www.te.com
Connector Manufacturer
TCT Mobile Limited
www.alcatelonetouch.com
The Subsidiary Company of TCL
Tektronix
www.tek.com
Test, measurement and monitoring solutions
Telecommunication Metrology Center (TMC)
www.emctte.com
Test Center
Texas Instruments (TI)
www.ti.com
Semiconductor IC Design and Manufacturing Company
Tongfang Global Limited
www.tongfang-global.com/
CE Manufacturer
Top Victory Investments Ltd
www.tvp-tech.com
DTV Manufacturer
TransSwitch (Israel) Ltd
www.transwitch.com
Semiconductor Solutions Provider
TSAY-E (BVI) International Inc.
www.tsayes.com.tw
Cable manufacturer
TTE Corporation
<http://www.tcl.com/en/phy>
The Subsidiary Company of TCL
U
UBIVELox, Inc
www.ubivelox.com
Mobile Platform Solution
W
Wanshin Electronic Co.,Ltd
www.wanshin.com.tw
Cable Manufacturer
Wireless Accessory Solutions LLC
www.ibolt.co
Smartphone Accessory Solutions
Wiretek International Investment Ltd.
www.wiretek.com.cn/web
Cable manufacturer
Wistron Corporation
www.wistron.com
PC, Laptop, or Monitor Manufacturer
Y
YAMAHA CORPORATION
www.yamaha.com
AV receivers
Yeonhab Precision Co., Ltd
www.yeonhab.com
Cable manufacturer
YFC-BonEagle Electric Co., Ltd.
www.cables.com.tw
Manufactures power cord sets, LAN cable, patch cords
Z
ZTE Corporation
www.zte.com.cn/en/
Global provider of telecommunications equipment



MHL In Today's Hottest Mobile Devices



	 Galaxy S3	 Galaxy S2
 Galaxy Note 1, 2	 Galaxy Nexus	 Infuse



	 Optimus LTE II	 Optimus LTE	 Nitro HD	 Spectrum	 Captivate Glide
 Optimus G	 Optimus 3D Max	 Optimus 4X	 Optimus LTE Tag	 Optimus Vu	



 HUAWEI	 Ascend P1, P1 S	 Ascend D1, D1 Quad
--	--	---



	 PF200	 Era
---	--	--



	 VEGA LTE
---	--





	 S2
---	--













	
--	--

	
--	---

	 Xperia T, TX, V, GX and SX
---	--

	 AQUOS ISW16SH
--	--

	 Find 3
	 Phone 2

	 One X and One XL	 One S
 EVO 3D	 EVO 4G LTE	 Vivid
 Raider	 Amaze	 Rezound
 Sensation/ Sensation XE	 Jetstream	 Flyer

Major DTV Brands Embrace MHL



46ES8000, 55ES8000, 60ES8000, 65ES8000 ,
46ES7500, 55ES7500 , 60ES7500,
46D8000, 55D8000, 60D8000, 65D8000,
46D7900, 55D7900,
46D7000, 55D7000, 60D700



TM2792, 72LM9500, 55LM9600,
55LM8600, 47LM8600



NS-55E480A13A, NS-46E480A13A,
NS-46E480A13, NS-55E480A13



LC-24K7, LC-22K7, LC-19K7, LC-60LE745U, LC-
70LE745U, LC-90LE745U, LC-70C7450U, LC-
60C7450U, LC-70LE845U, LC-60LE845U, LC-
70LE847U, LC-60LE847U, LC-80LE844U, LC-
70C8470U, LC-60C8470U, LCD-46LX840A, LCD-
52LX840A, LCD-60LX840A



55RW1, 47RW1, 46VL20, 40VL20, 46TL20, 40TL20, 55WL863
46WL863, 42WL863, 55WL800A, 46WL800A



KLV-32EX330, KLV-32EX33A, KLV-
32EX33B, KLV-40EX430, KLV-
40EX43A, KLV-40EX43B, KLV-
24EX430

Announced MHL Monitors and Projectors



HDTV Monitors: T24B750V, T27B750V, T23B550V,
T27B550V

LED Monitors: 27B970D, S24B750V, S27B750V,
S23B550V, S27B550V, SB970

Smart Station : C24B750X, C27B750X, C24B550U



EA93, IPS277L, IPS237L



23" Philips IPS display with Smart MHL



Aiptek MobileCinema



Mini Projector

Other Announced MHL Products & Accessories

ONKYO



A/V Receiver

SHARP



AQUOS Media Station BD-AMS20U

Pioneer



AppRadio 2
In-Dash Car Receiver



MHL to HDMI, VGA adapters, cradles, cables

Innovative MHL Use Cases



ROKU Streaming Stick with MHL



Smart
DTV



SAMSUNG
Galaxy S3



kt Korea
Telecom
Spider Laptop



Notebook
PC



Overview of the MHL Standard

MHL Consortium

- *MHL was founded by leading Mobile and Consumer Electronics companies:*



SONY

TOSHIBA

- *MHL 1.0 specification released June 2010*

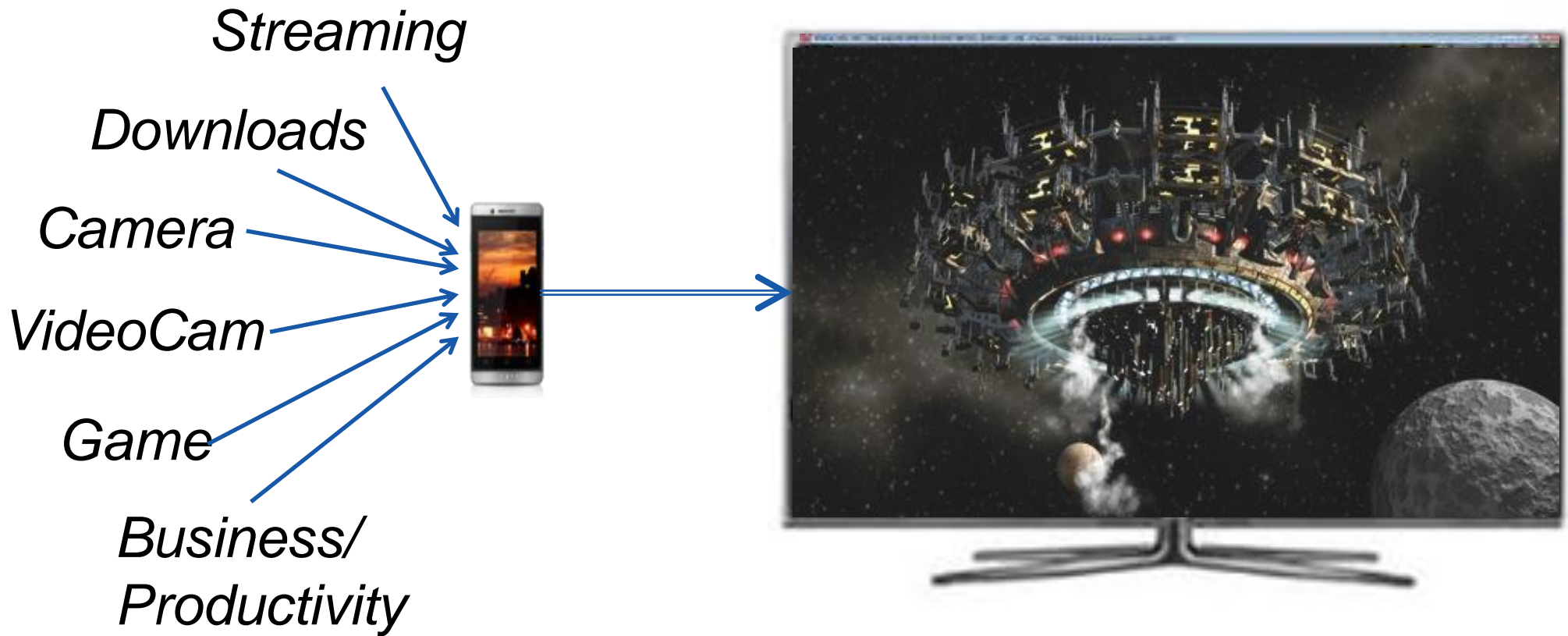
Key Features

- *Low pin-count 1080p60 HD video & digital audio interface*
- *Architected to be used with any mobile connector*
- *MHL Sink provide power to the mobile device*
- *Interoperable remote control function*

MHL: Connectivity for the Mobile Community



MHL – Content On the Go



MHL – Evolution

CTS1

MHL1
June 2010

Digital Connectivity

1080p60 Video

Digital Audio

-8 channels, 192kHz, 24bit

-Compressed, Dolby & DTS

Power, battery charging

Device Control

CTS2

MHL2
April 2012

3D Video

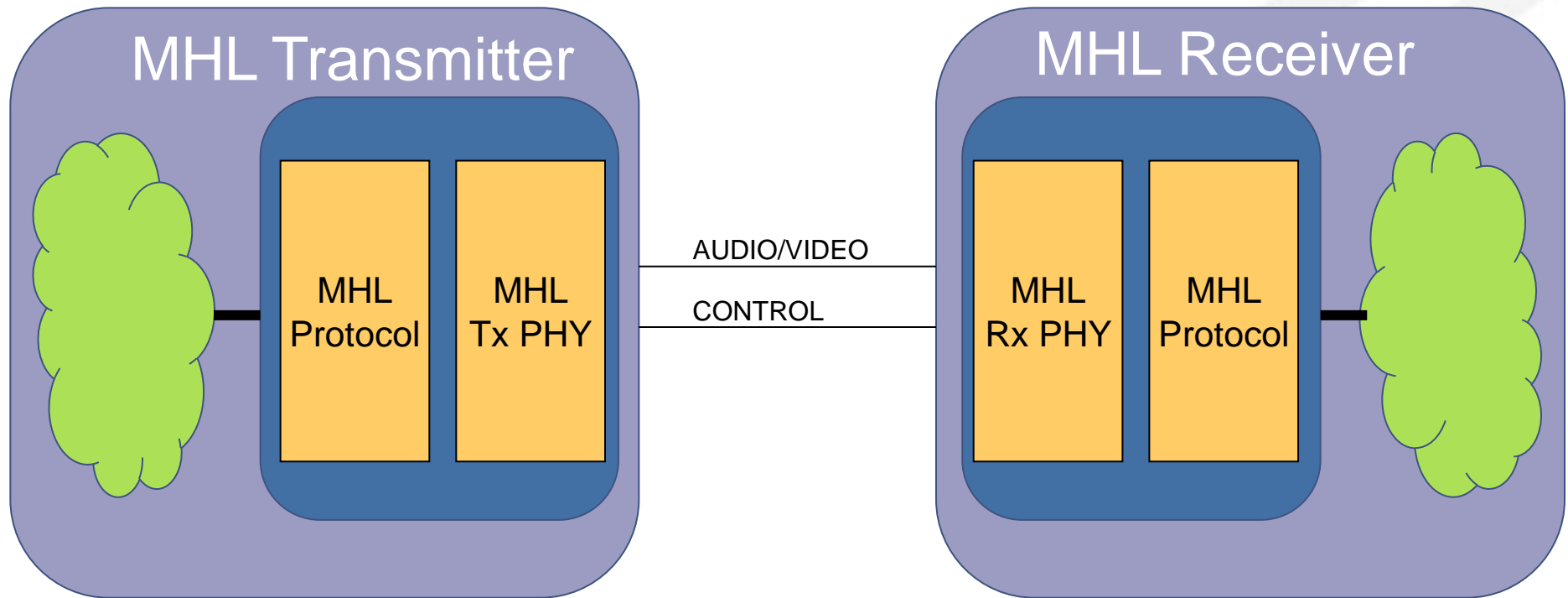
Increased Power, battery
charging

Enhanced Device Control



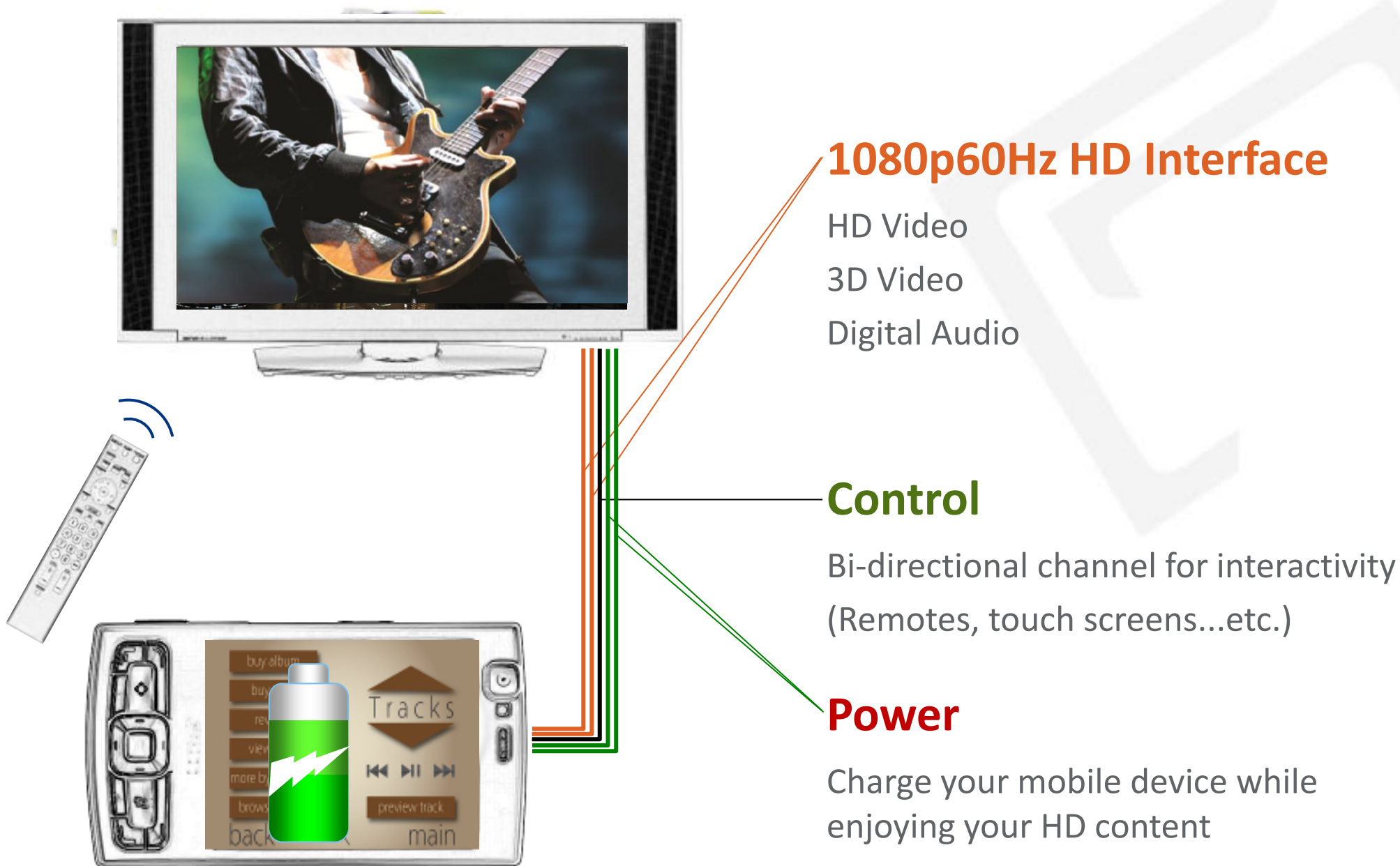
MHL Technology

MHL – Architectural Overview



Baseband Transmission

MHL Technology



MHL is Connector Agnostic

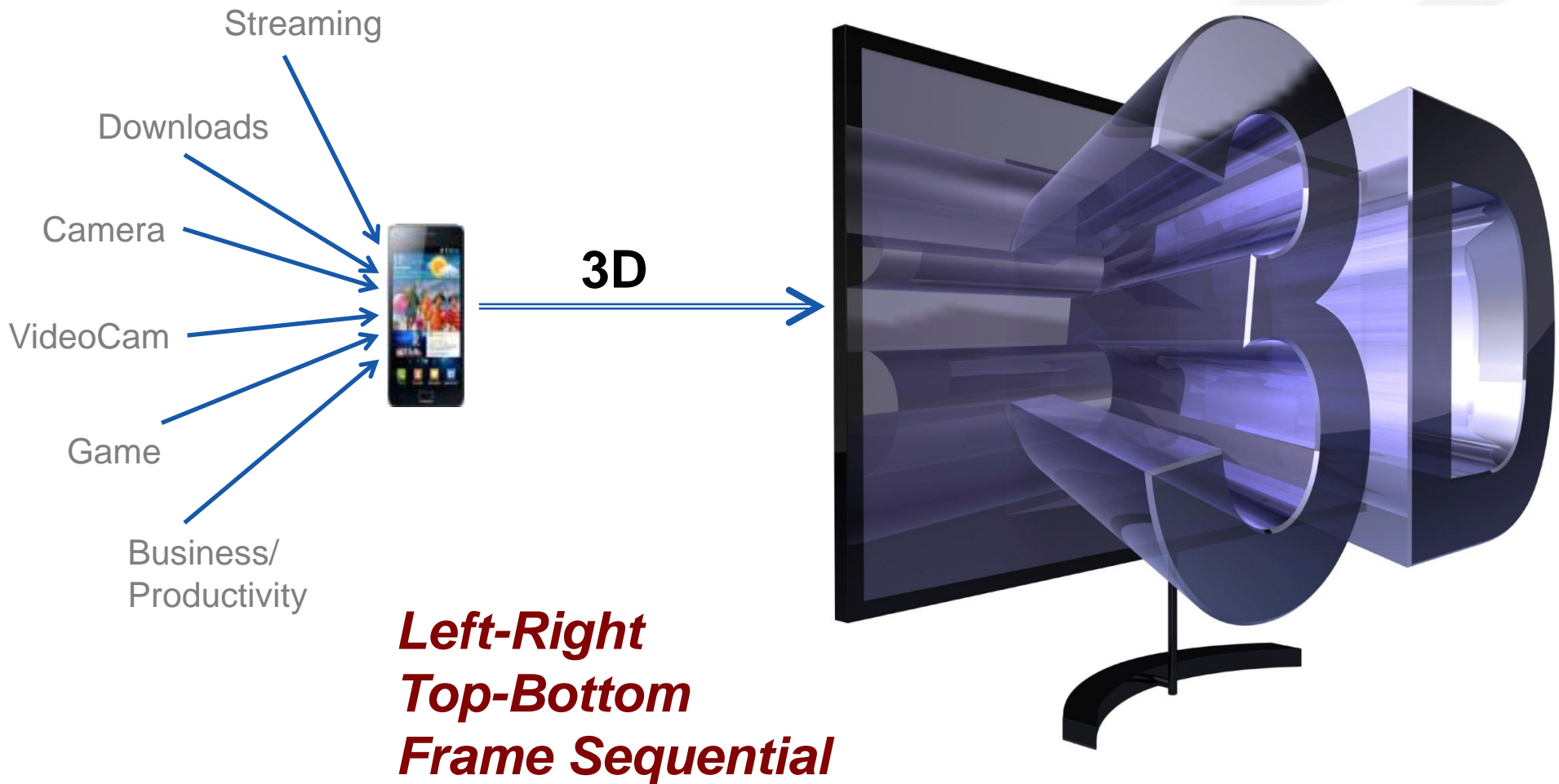
- ◆ MHL allows connector to be multi-purposed for
 - HD Audio & Video
 - Data
 - Power
- ◆ Reduces mobile device cost
- ◆ Saves connector & board space
- ◆ Enhances industrial design



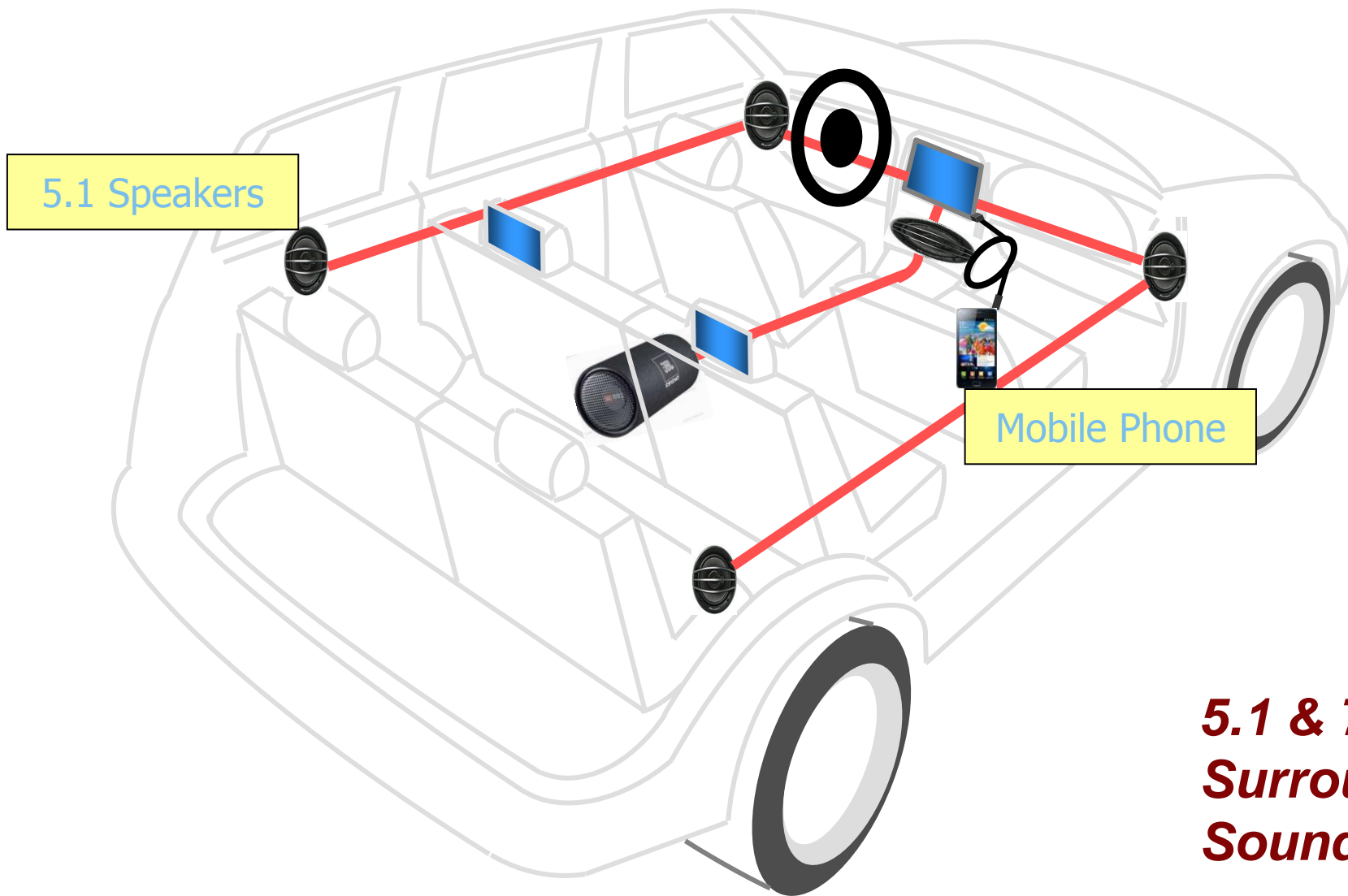
MHL Video



MHL Video (cont.)



MHL Audio



**5.1 & 7.1
Surround
Sound**

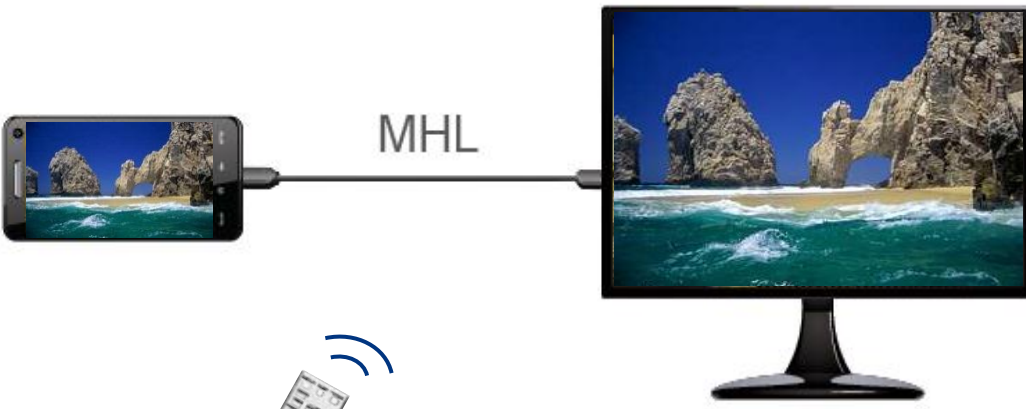
MHL – Power



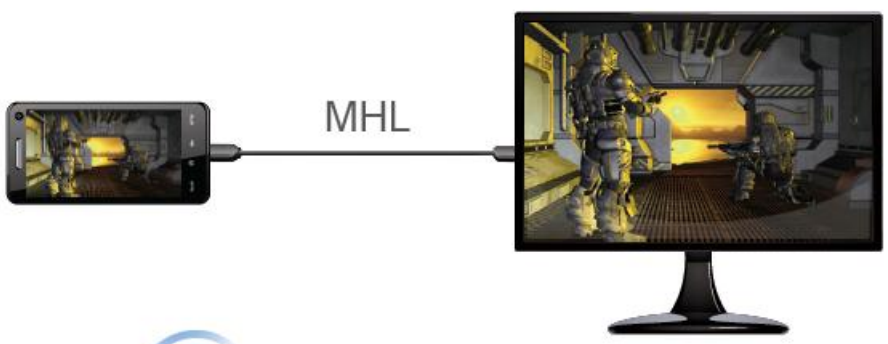
***Simultaneous Charging
for the
Mobile Device***



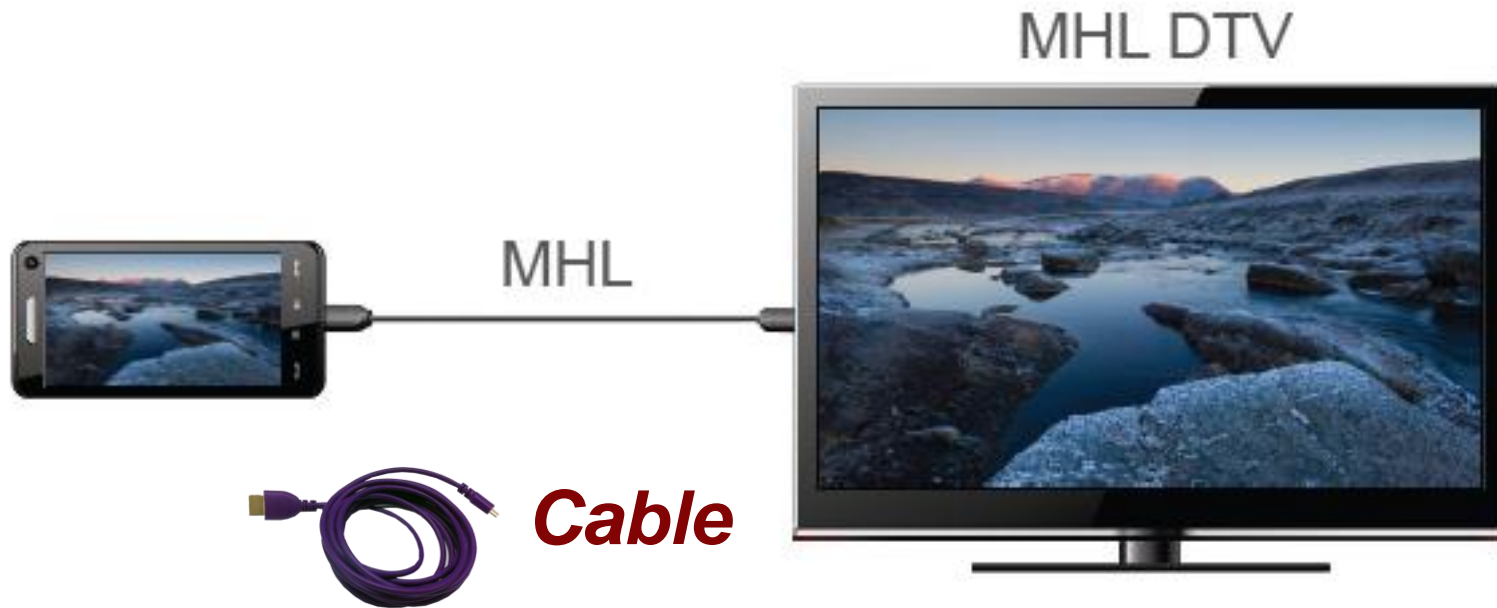
MHL – Control



PC Monitor



Connecting MHL



MHL to HDMI, VGA adapters, cradles



Summary

Summary

HD connectivity to larger displays is essential for the ultimate, interactive experience from mobile device

MHL is the de facto choice for mobile to display connectivity

Delivering a premium quality, real-time HD experience

Silicon Image, a founding Promoter of MHL, delivers HD video connectivity, wired or wirelessly, that just works

More Information

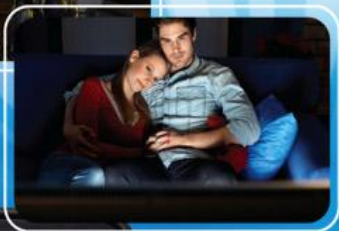
- ◆ Additional information is available at:

www.siliconimage.com

www.mhlconsortium.org



Mobile High-Definition Link



Thank You!

Questions & Answers