2017 Communication Technology Update

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CES Eye Candy: VR and AR

CES Eye Candy: Automotive

Virtual Reality—A Closer Look

- Traditional applications
  - Training
  - Architecture

- Emerging markets
  - Gaming **
  - Entertainment
  - Journalism/Storytelling

Augmented Reality

- Overlay of images on reality using screens, holograms, etc.
  - Signage
  - Gaming
    - Pokemon Go!
  - Navigation
  - Translation

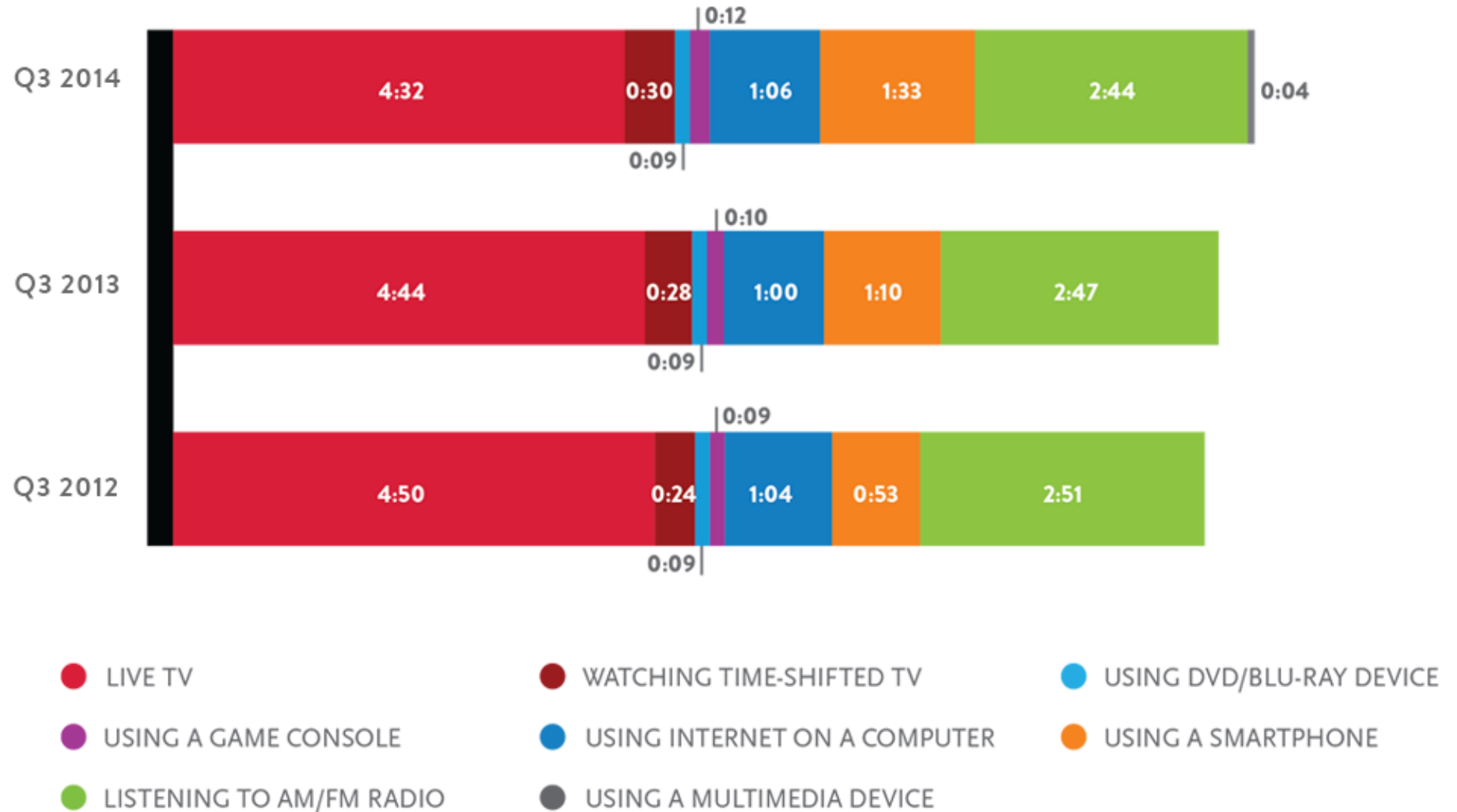- Note integration of GPS, networking, storage, user ID, and objective

Television Today—Audience

- Little change in 2016
  - Most popular medium in U.S.
  - Most advertising revenue
  - Most different ways to consume

AVERAGE TIME SPENT PER ADULT 18+ PER DAY

Q3 2014
- Live TV: 4:32
- Watching Time-Shifted TV: 0:30
- 0:09
- 0:12
- Using Internet on a Computer: 1:06
- Using a Smartphone: 1:33
- Listening to AM/FM Radio: 2:44
- 0:04

Q3 2013
- Live TV: 4:44
- Watching Time-Shifted TV: 0:28
- 0:09
- 0:10
- Using Internet on a Computer: 1:00
- Using a Smartphone: 1:10
- Listening to AM/FM Radio: 2:47

Q3 2012
- Live TV: 4:50
- Watching Time-Shifted TV: 0:24
- 0:09
- 0:09
- Using Internet on a Computer: 1:04
- Using a Smartphone: 0:53
- Listening to AM/FM Radio: 2:51

Legend:
- ● LIVE TV
- ● WATCHING TIME-SHIFTED TV
- ● USING DVD/BLU-RAY DEVICE
- ● USING A GAME CONSOLE
- ● USING INTERNET ON A COMPUTER
- ● USING A SMARTPHONE
- ● LISTENING TO AM/FM RADIO
- ● USING A MULTIMEDIA DEVICE

Source: Nielsen.

Biggest TV Spotlight at CES2017

4K and HDR

Television Update: 4K

- 4K penetration rising
  - 2014: 2%
  - 2015: 4-5%
  - 2016: 10%
- Premium product

- BUT: Viewers can't see the difference
- AND Little 4K content is available

4K Distribution

- Today
  - IPTV
  - DirecTV

- Coming soon…
  - Cable Television
- 2020 or later
  - Broadcast

Television Update: HDR

- HDR=High Dynamic Range
  - Superior color
  - Superior contrast ratio
  - More bandwidth needed
- Separate encoding and decoding needed
  - First adoption has been in cinemas
  - Decoding is built in to high-end TVs
  - BUT, will viewers be able to see the difference?

Television Update: OTT

- Multiple services available:
  - a la carte:
    - HBO GO
    - CBS AllAccess
    - ESPN 3
  - Packages
    - Sling
    - DirecTV Now
    - (Soon) Every cable operator

New OTT Driver

Internet of Things (IoT) Update

- Potential growth area of consumer electronics
  - Embedded processing power
  - Embedded sensors and displays

- Unorganized industry
  - Multiple OS
  - Multiple network solutions (Bluetooth, NFC, etc.)
  - Internet resources (data, processing, memory, etc.)
  - Authentication/security/privacy
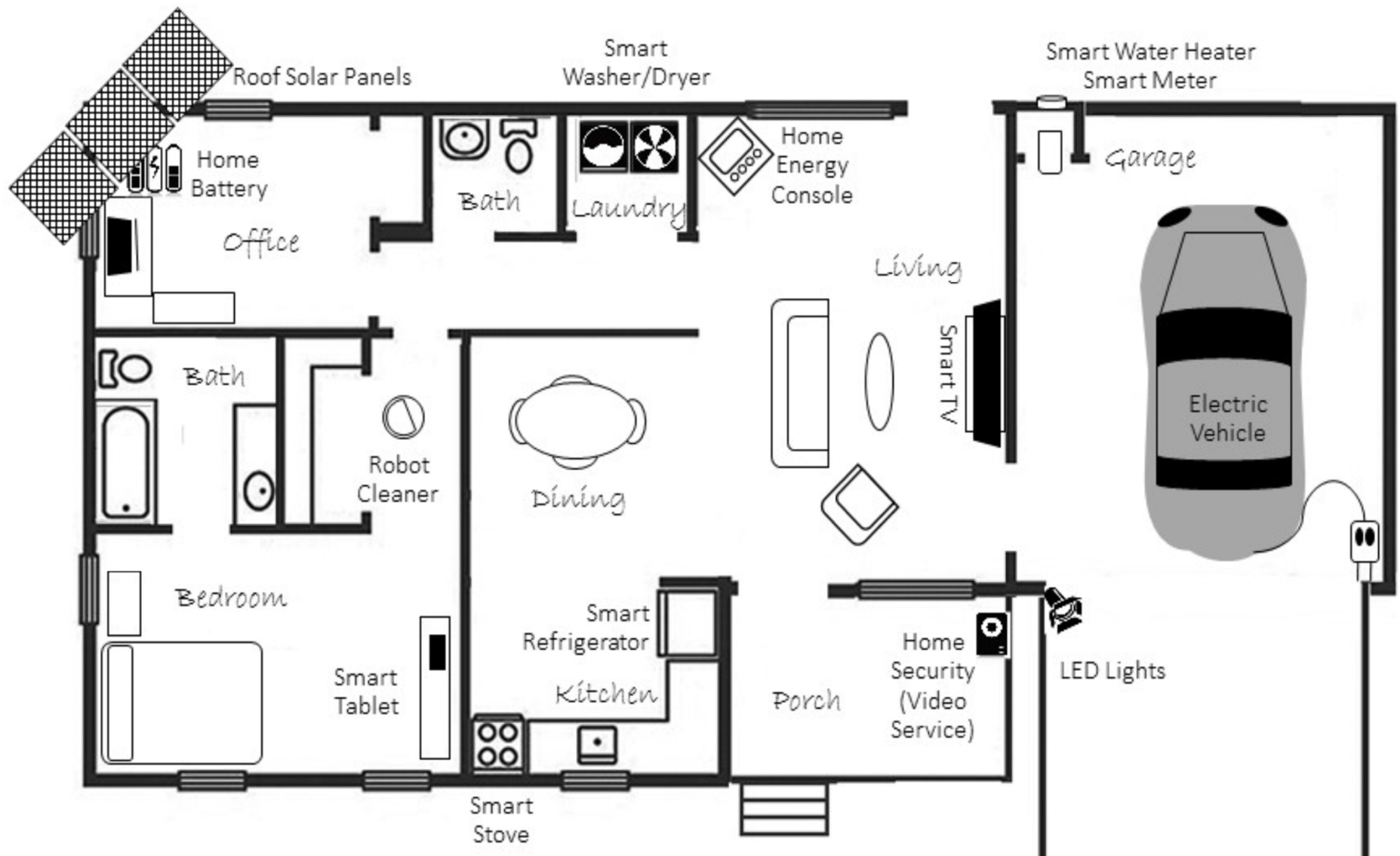
Next IoT Wave: Personal Assistants

- Google Home and Amazon Alexa

Personal Assistant+ IoT=$$$$$

- Two voice response trajectories:
  - Centralized (Alexa and Google Home)
    - Technical standards
    - Central storage
    - Networked features
  - Isolated (Distributed voice input)
    - Multiple standards
    - May or may not be networked
    - Fewer privacy/security concerns
- Either: Marginal increase in network demand

IoT=Smart Houses

Roof Solar Panels

Smart Washer/Dryer

Smart Water Heater
Smart Meter

Home Battery

Home Energy Console

Garage

Bath

Office

Laundry

Living

Smart TV

Bath

Electric Vehicle

Robot Cleaner

Dining

Bedroom

Smart Refrigerator

Smart Tablet

Kitchen

Porch

Home Security (Video Service)

LED Lights

Smart Stove

One More IoT Issue

- Desirable, direct, and anticipated impacts go together
- Undesirable, indirect, and unanticipated impacts go together
  - Alexa and the pizza…
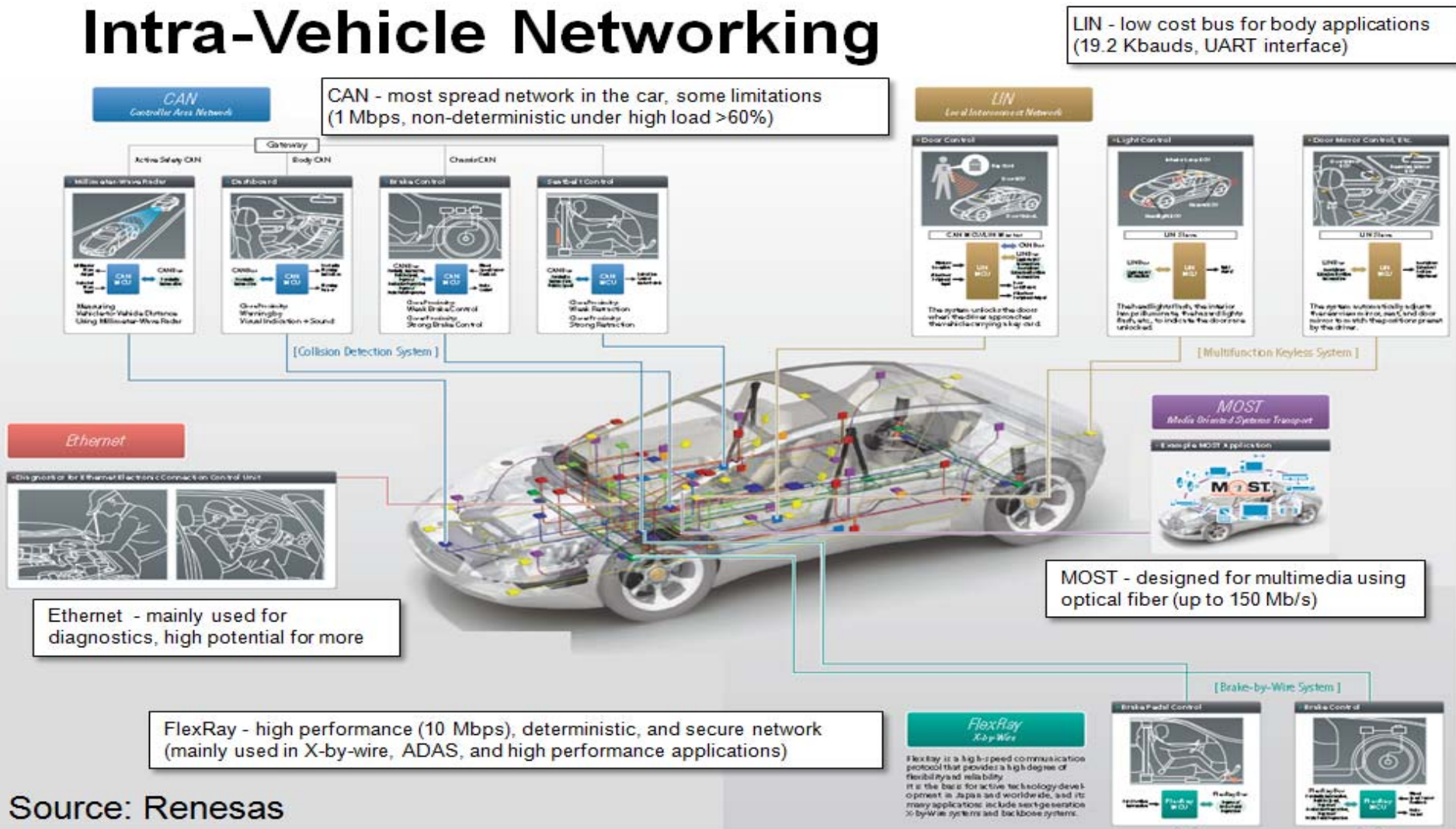
Networking Update

- IoT=New requirements for ISPs
  - Auto connectivity
  - Home security connectivity
  - Mobile device connectivity
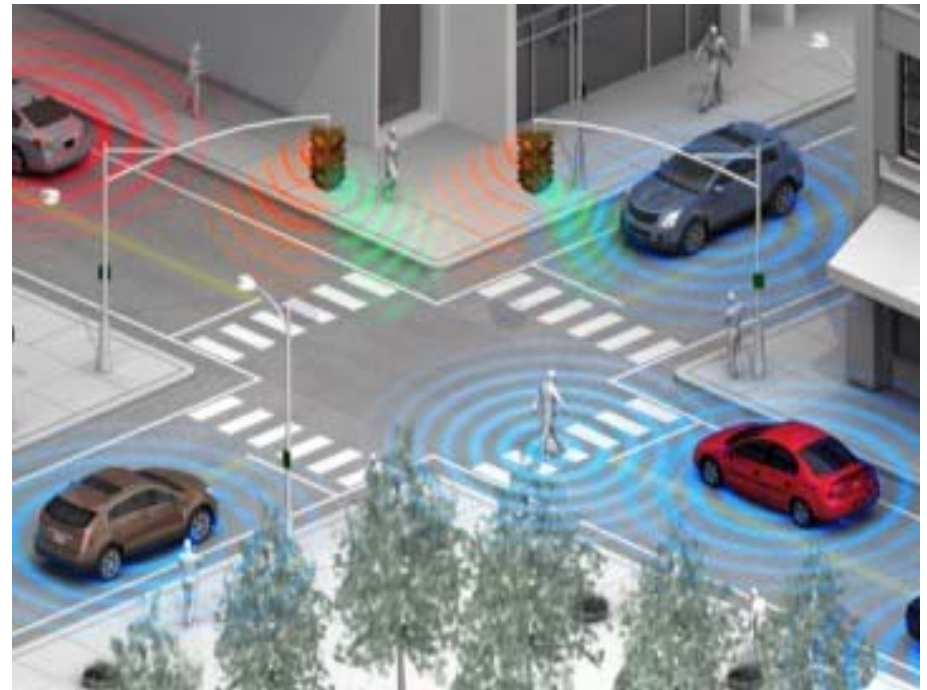 - Personal assistant

Automotive Update

Automotive Update

Intra-Vehicle Networking

LIN - low cost bus for body applications (19.2 Kbauds, UART interface)

CAN - most spread network in the car, some limitations (1 Mbps, non-deterministic under high load >60%)

Ethernet - mainly used for diagnostics, high potential for more

MOST - designed for multimedia using optical fiber (up to 150 Mb/s)

FlexRay - high performance (10 Mbps), deterministic, and secure network (mainly used in X-by-wire, ADAS, and high performance applications)

Source: Renesas

Automotive Implication

- Biggest user of mobile bandwidth may be automotive industry
    - Navigation
        - Real-time traffic
        - Vehicle to vehicle
    - Entertainment
    - Information
    - Safety
    - Operational efficiency

Telephony Update

- Network capacity indicators
  - Results of FCC Spectrum auction
    - $18 B instead of $84 B
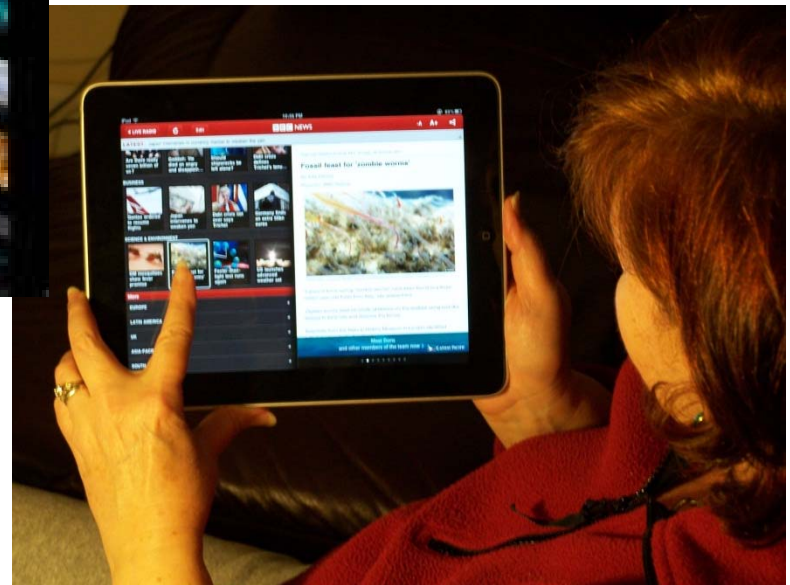   - 84 Mhz instead of 126 Mhz

- Evolution of networks
  - 5G
  - 6G

Computer Update

- Mobile
- Mobile
- Mobile
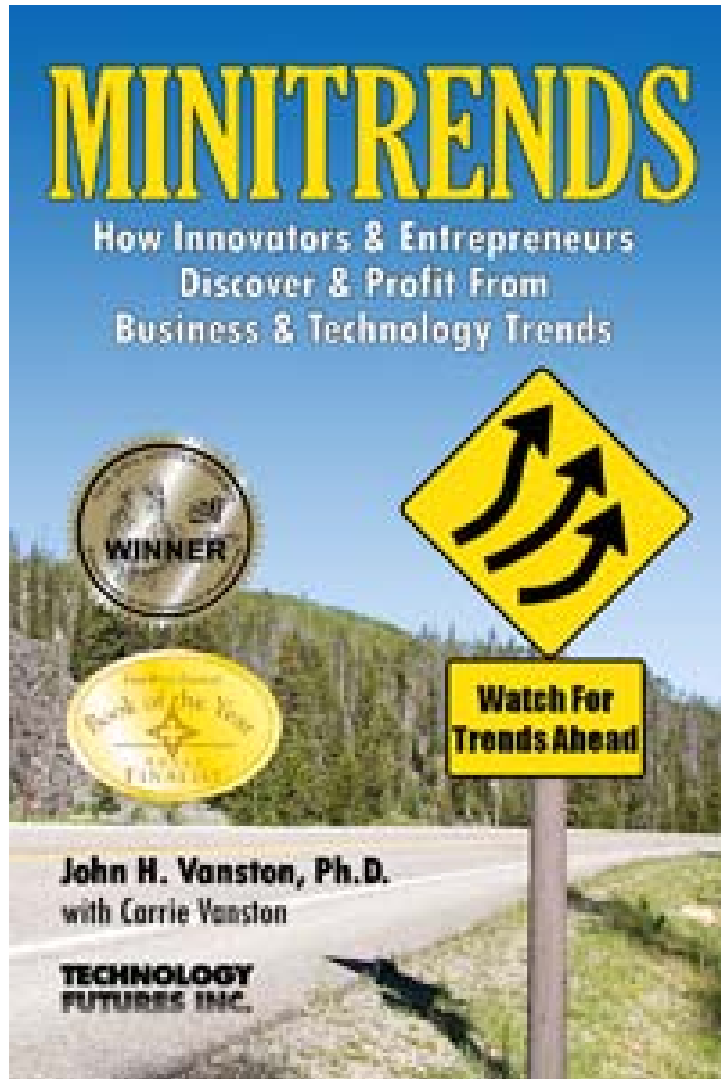- Mobile
- Mobile
- Mobile
- Mobile

Mobile Technology Update

- User base stable
  - Tablets
  - Smart phones
- Multiple devices per person
- "Free" WiFi continuing to proliferate
- Shift in advertising spending to mobile media

Video Everywhere...

MiniTrends

- Trump appoints Pai as FCC Chair
- Results of FCC Spectrum Auction
- Demand for Alexa
  - Multiple units in household
- AT&T purchase of Time Warner

Thank you!

More Info:
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