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o Vehicles must manage multiple generations of

- Applications
- Consumer devices (smartphones, etc.)
- Applications for consumer devices

Applications

Smartphones

Vehicle: electronics

Vehicle: mechanical

SOP · Year 5 · Year 10

■ Current ■ Old ■ Obsolete
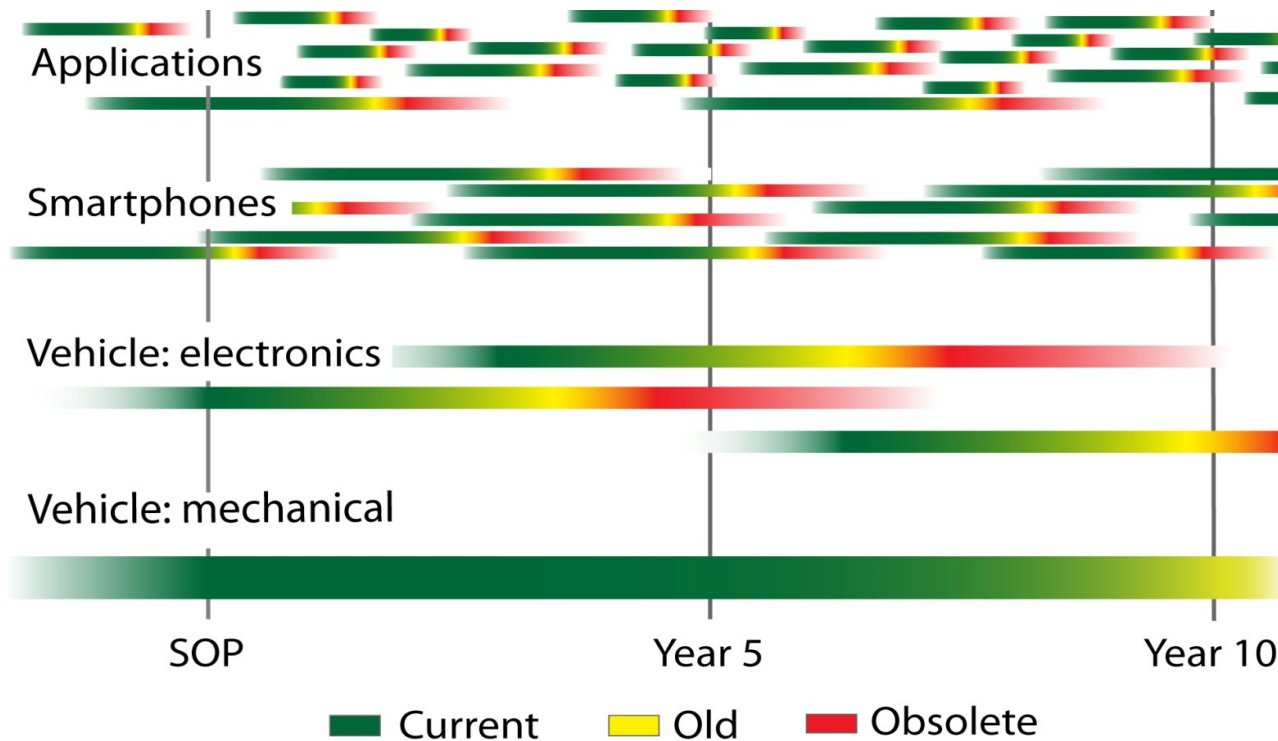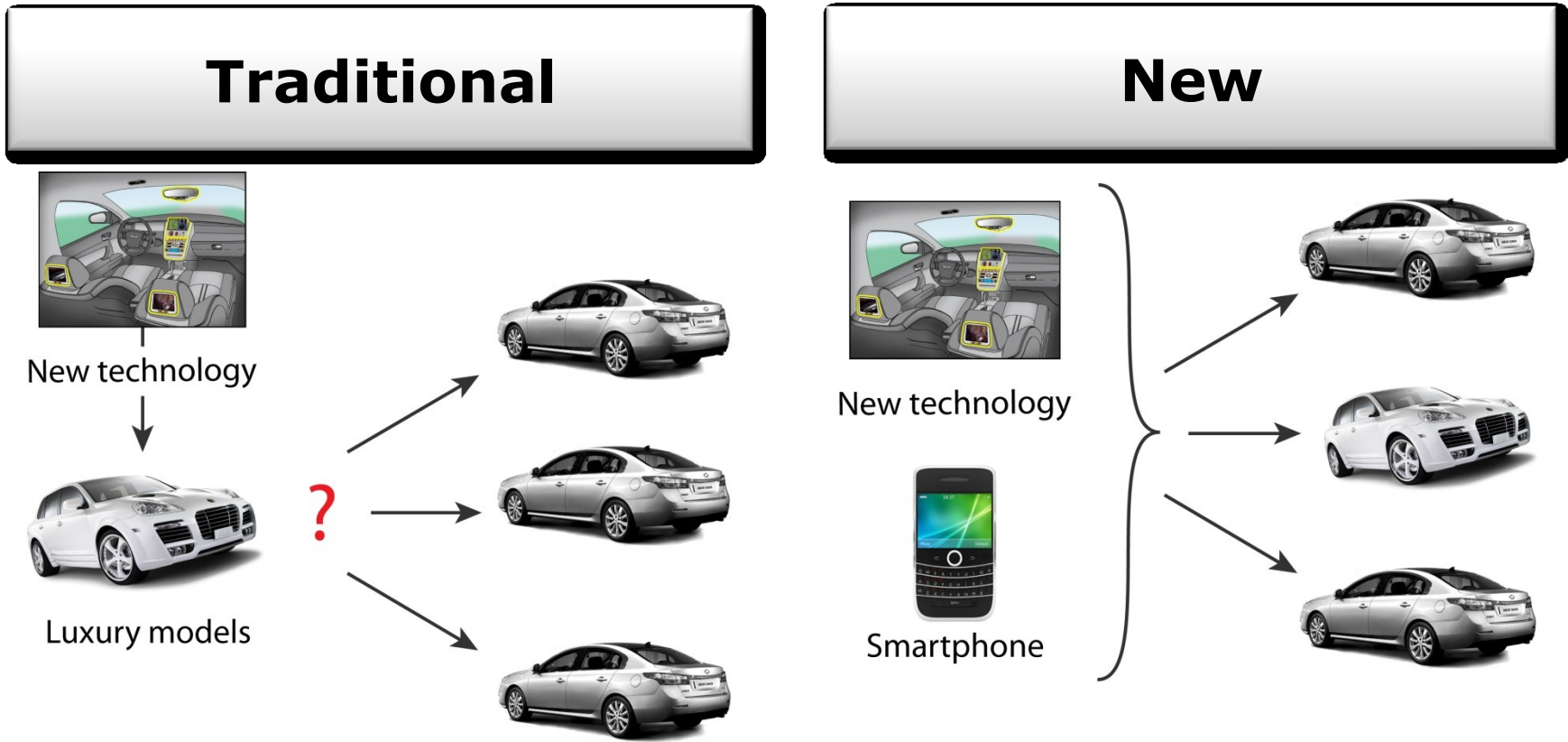
The advent of the smartphone has changed the way automakers introduce new technology into their vehicles.
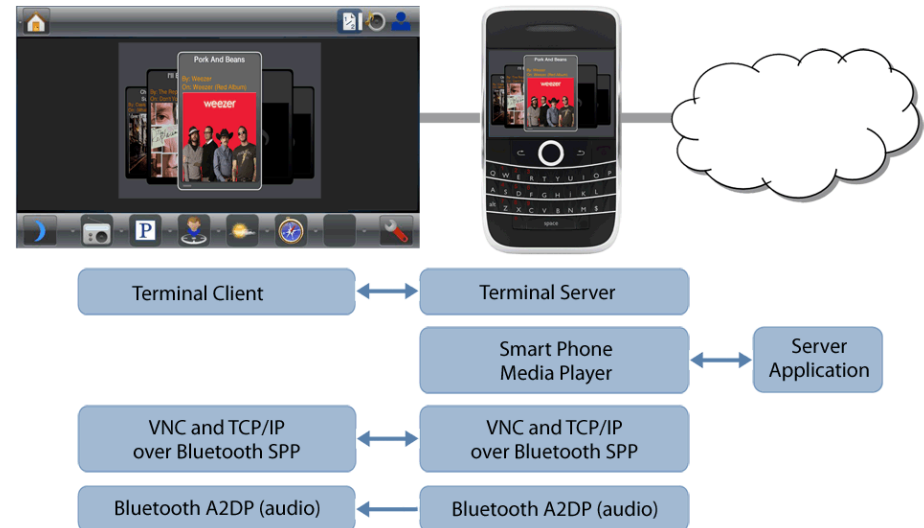
o Already in use in millions of vehicles

o Head unit is responsible for all

- HMI
- Applications
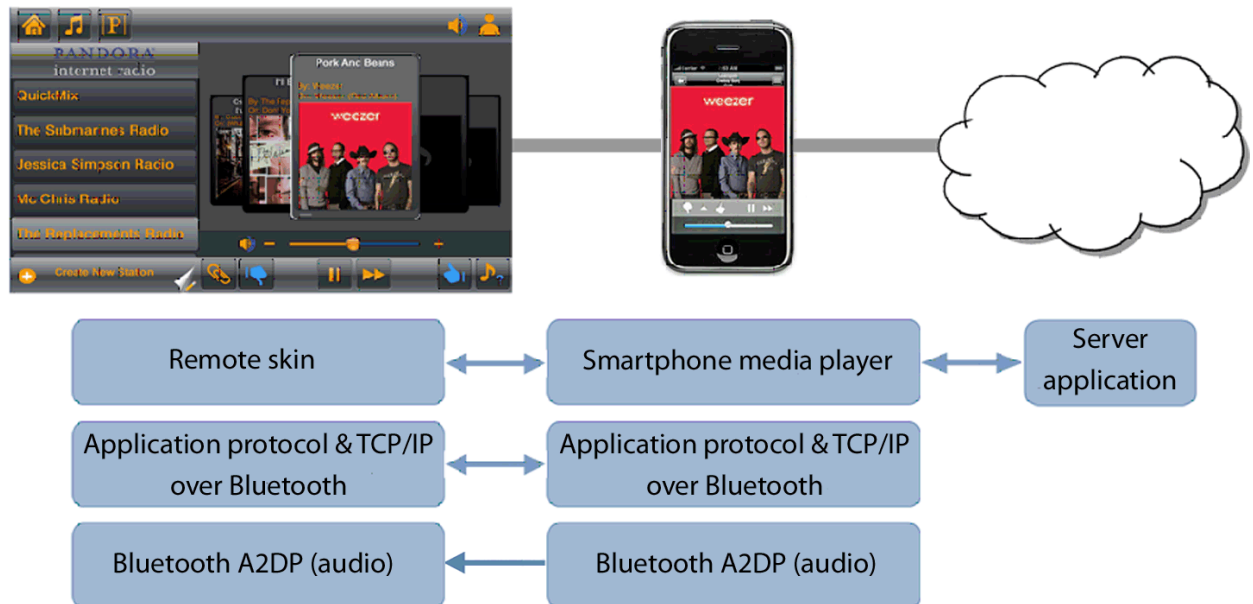- Connectivity
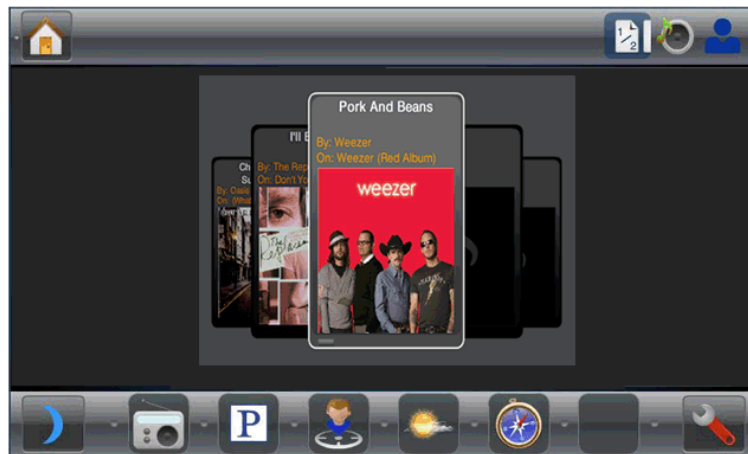
HMI & applications

o   Applications reside in the smartphone

o   Connectivity to the cloud through the smartphone

o   Smartphone-head unit connectivity via USB or Bluetooth

o   Server-client architecture

- Smartphone acts as server to the head unit's VNC client

- Client on the head unit replicates the smartphone HMI

o   Spec has provision for "car-specific" mods to HMI

Terminal Client ↔ Terminal Server

Smart Phone Media Player ↔ Server Application

VNC and TCP/IP over Bluetooth SPP ↔ VNC and TCP/IP over Bluetooth SPP

Bluetooth A2DP (audio) ← Bluetooth A2DP (audio)

o Access iPhone or iPod Touch through vehicle head unit

- iPod/iPhone runs apps
- iPod/iPhone outputs content to vehicle screen
- Head unit + vehicle audio is conduit for video + audio
- Head unit controls user interface

o Commands from head unit delivered via iPod accessory protocol

o Apple proprietary (i.e. Apple devices only)

Audio

Video

iPod accessory protocol

Remote Skin

o Infotainment system uses its own app-specific lightweight HMI

o HMI uses TCP/IP connection over Bluetooth or USB to connect to smartphone

o Applications run on smartphone

o From perspective of smartphone, the HMI (skin) is remote

o Vehicle head unit controls smartphone applications

o Head unit-smartphone connectivity through Bluetooth

o Minimalist HMI on head unit

o Protocol transfers icons, text and labels for two buttons to head unit

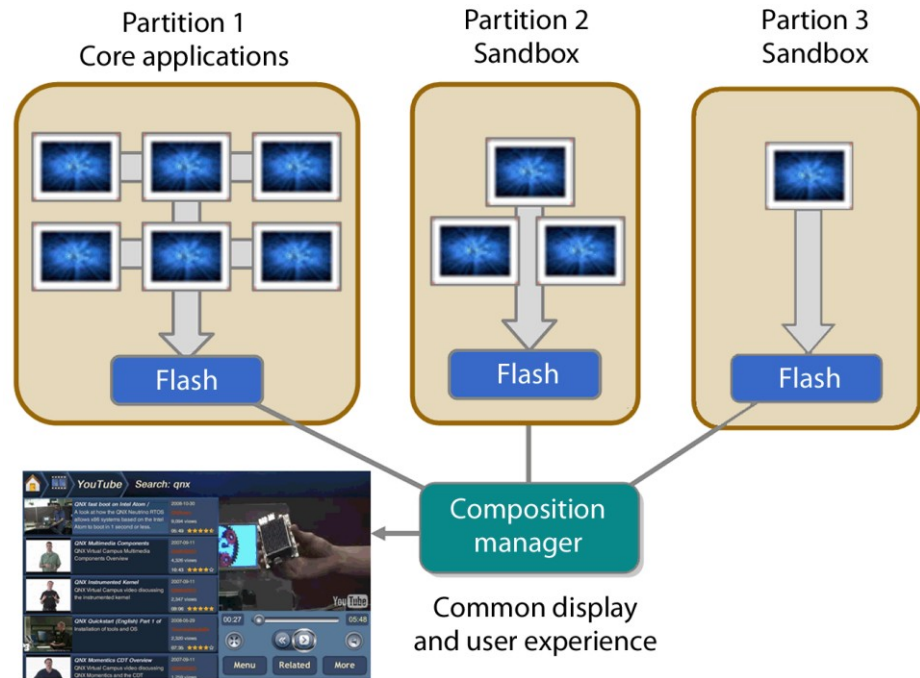o Smartphone application uses in-vehicle user interface however it wants
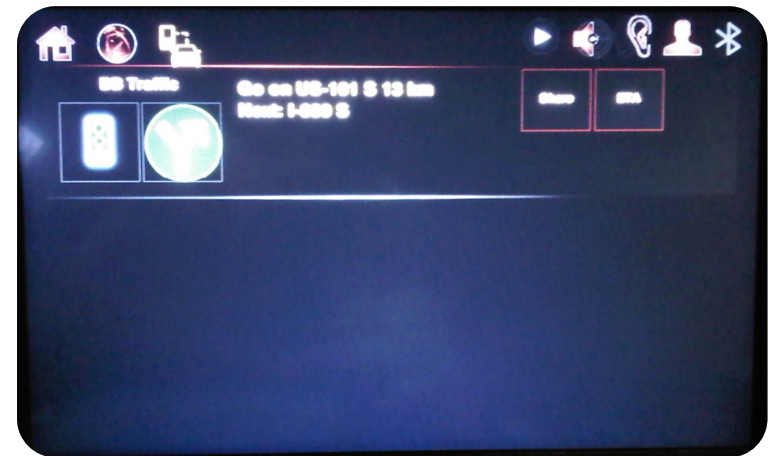
o In-vehicle infotainment systems must integrate with smartphones

o Many integration models today (more to come?)

o No model is ideal

o One size does *not* fit all

o Need to implement a blend of models

o Design in-vehicle system to
easily integrate new technologies and updates

o Choose the application platform carefully

Safe and secure browsing, downloads and installations

Partitions guarantee CPU time and protect memory

Partition 1
Core applications

Partition 2
Sandbox

Partion 3
Sandbox

Flash

Flash

Flash

Composition manager

Common display and user experience

Something to Read

o Gryc, Andy. "Making Sense of the Smartphone-Vehicle Cacophony". QNX Software Systems, 2001. www.qnx.com/download/

o Jayaraman, Krishna. "Smart Phones in Cars — In-Vehicle Infotainment Upside Down!" Frost & Sullivan, 26 Oct. 2010. http://www.frost.com/prod/servlet/market-insight-top.pag?docid=213640719

o Johnson, Kerry. "Mobile device connectivity keeps the car relevant". *EE Times Design*, 11 Nov. 2010. http://www.eetimes.com/design/automotive-design/4210672/Mobile-device-connectivity-keeps-the-car-relevant

Thank you!

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