The Networked Car: Technology and Use Case Drivers

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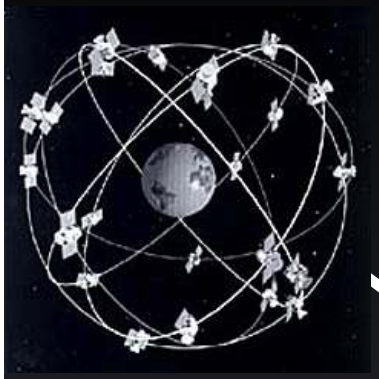
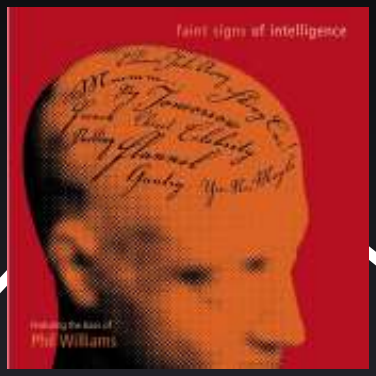
Is This the Future?

What would it take to do that?



DATA

Collection



INTELLIGENCE

NETWORKS

Distribution

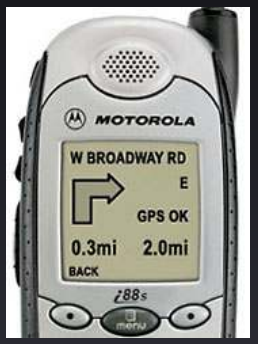
INTERFACES

Why Connect the Vehicle?

- Bring the World With Us
  - Communications
  - Entertainment

Why Connect the Vehicle?

- Operate the Vehicle
  - Navigation
  - Maintenance
  - Safety

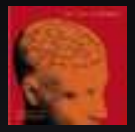


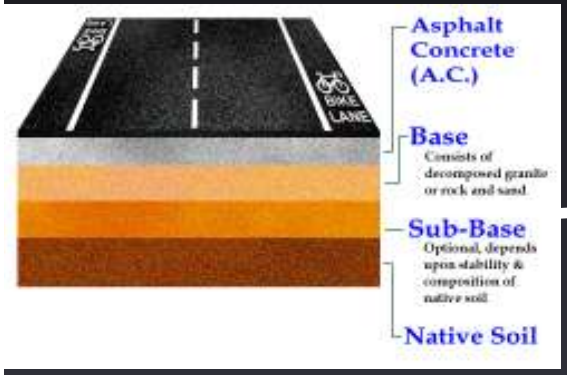
Connecting to the Car

- Client in the Vehicle
  - Carry in
  - Aftermarket
  - Line fit
- Network to Reach the Vehicle
  - Broadcast
  - General Purpose
    - Cellular, WiMAX, WI-FI
  - Purpose Built
    - Vehicle Specific, Application Specific

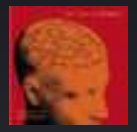
USE CASE	DEVICE	NETWORK
Communications	Carry in	General Purpose
Entertainment	Line fit Aftermarket Carry in	Broadcast
Navigation	Line fit Carry in	General Purpose
Maintenance	Line fit	General Purpose
Safety	Line fit Aftermarket	Purpose Built

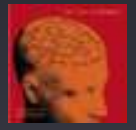
Making Driving Safer

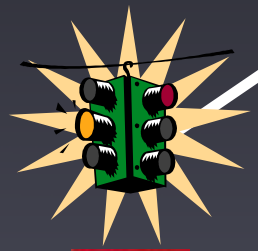


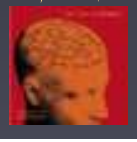


DSRC









USDOT Programs

- IVBSS
  - Integrated Vehicle Based Safety Systems
    - http://www.its.dot.gov/ivbss/
- CICAS
  - Cooperative Intersection Collision Avoidance Systems
    - http://www.its.dot.gov/cicas/index.htm
- VII
  - Vehicle Infrastructure Integration
    - http://www.its.dot.gov/vii/

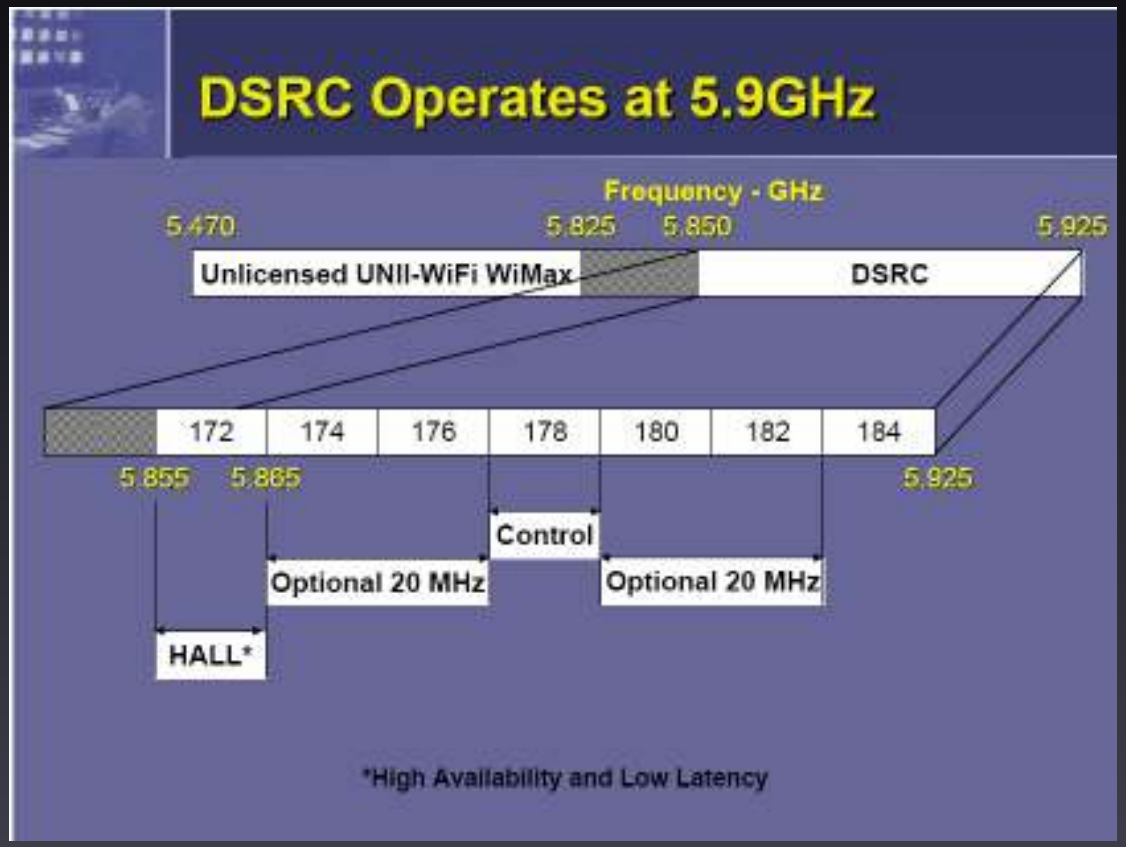
European Activity

- CALM
  - Continuous Air interface for Long and Medium distance
- Car2Car Communications Consortium

DSRC

Dedicated Short Range Communications

- Spectrum
  - US FCC and European Community has allocated spectrum in the 5.9 GHz Band for VII
  - Japan has not yet allocated dedicated spectrum
- Operating Characteristics
  - Vehicle speeds of up to 100 mph (closure speeds of 200 mph)
  - Less than 50 ms of network latency
  - 8 levels of applications priority
  - Dedicated channel (Channel 172) to vehicle safety
  - Robust security model
    - Encrypt using Public Key Infrastructure (PKI)
    - Road Side Unit (RSU) Authentication
    - On-Board Unit (OBU) Privacy



Standards Spread through Multiple Venues

- ASTM
  - Basic technology approach, FCC rules
- IEEE 802.11p
  - Phy layer performance for vehicle speeds
- IEEE 1609
  - .1 - .4
  - MAC through Network layer, Security
- SAE
  - Message sets to enable applications

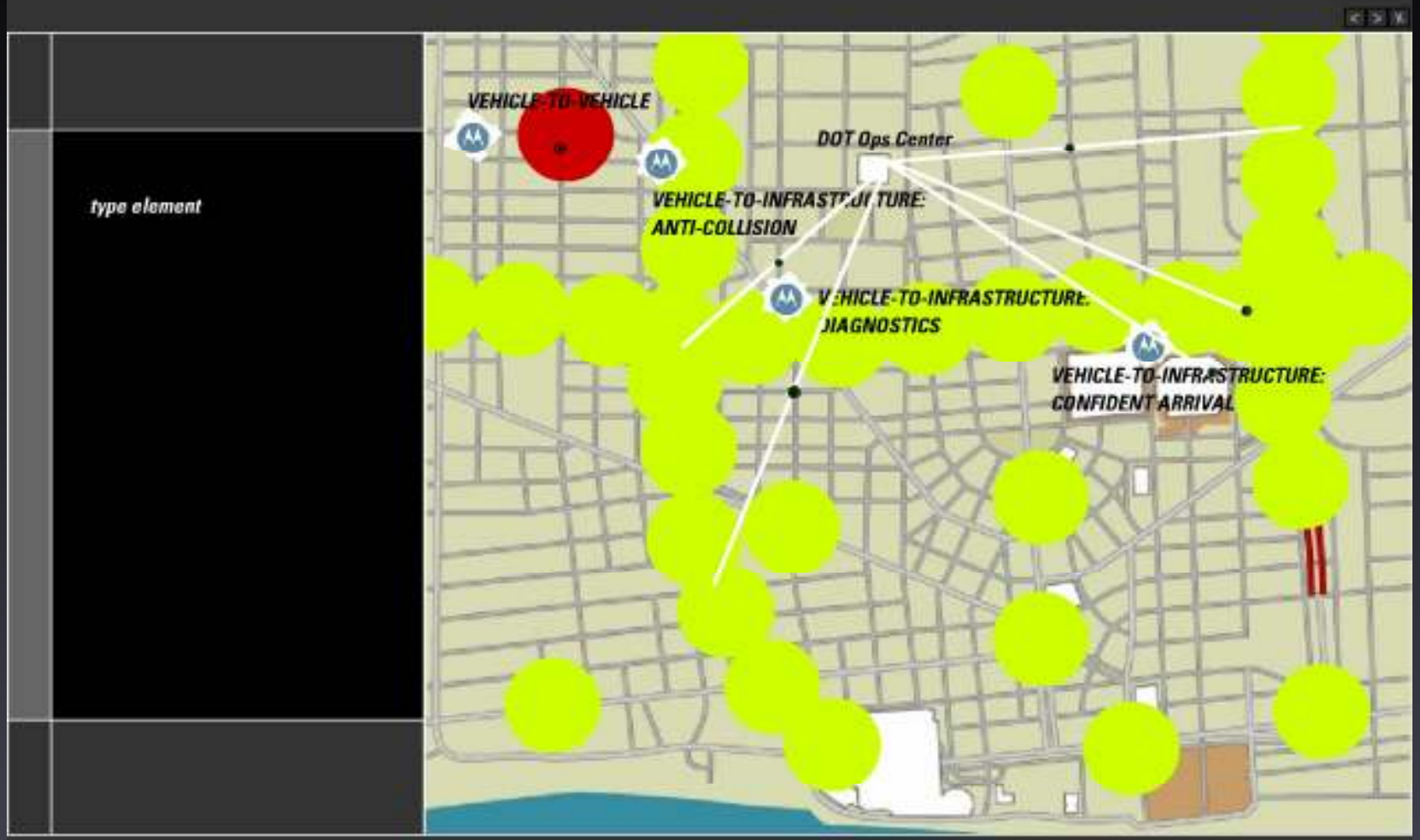
Status of DSRC

- 1609 approved for trial use only
- 802.11p failed 2nd letter ballot
- SAE in very early stadges

- Prototype radios to support VII and CICAS

- Open Technology Issues
  - Security
  - Ad Hoc and Client Meshing
    - At vehicular speeds

Or Is This The Future?



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