Killer Applications in Pervasive Computing

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Computing

- **Moore Law**
  - **Computing power**
- **Cell phone-PDA-Laptop-Desktop-Cluster-Supercomputer**
  - **Sequential**
  - **Parallel**
- **Applications**
  - **Sequential**
  - **Parallel**

Computing

The Next: Parallel World

- **New CPU**
  - Multi-core, Many core
- **New applications**
  - Multimedia, Entertainment, Learning, Globe business…
- **New landscape**
  - Innate parallel models
  - Skip MPI/OpenMP
  - Sequentialization parallel programming…

Communications

- **Circuit-Chip-Board-Node-Cluster-Supercomputer**
  - **Wired**
- **Inter-Node**
  - **Wired**
  - **Wireless**
- **Applications/Services**
  - **Wired**
  - **Wireless**

Communications

The Next: Wireless World

- **New wireless technology**
  - MIMOs, SDRs, Cognitive radios, Cooperative radios
- **New applications**
  - Safety services, Comfort services, Environment sensing services, Location-aware services…
- **New landscape**
  - Mobility models, Interference&link Capacity models
  - Multi-radio/channel selection/cooperation
  - Scalability, Reliability/Trust/Security…

Applications: ITS

- **VSC (US)**
- **C2CCC (Europe)**
- **InternetITS (Japan),**
- **Vehicle Infrastructure Integration Program (VII) (US)**

Killer Applications in Pervasive Computing?

VANET!

The Next: Parallel+Wireless+ITS

VANET Services

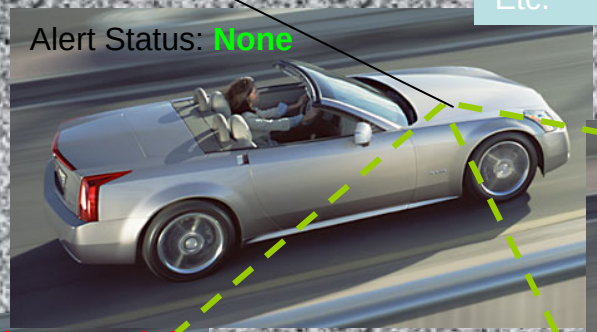
- **Safety Services**
  - **Emergency warning system**
  - **Lane-changing assistant**
  - **Intersection coordination**
  - **Traffic sign/signal violation waning**
  - **Road-condition warning**

- **Comfort Services**
  - **Traffic information system**
  - **Weather information**
  - **Gas station or restaurant location**
  - **Price information**
  - **Interactive communication: Internet access (chatting, online games), video/radio data**

Example (1): Safe Driving

Vehicle type: Cadillac XLR
Curb weight: 3,547 lbs
Speed: 75 mph
Acceleration: **+ 20m/sec^2**
Coefficient of friction: .65
Driver Attention: Yes
Etc.

Vehicle type: Cadillac XLR
Curb weight: 3,547 lbs
Speed: 65 mph
Acceleration: **- 5m/sec^2**
Coefficient of friction: .65
Driver Attention: Yes
Etc.

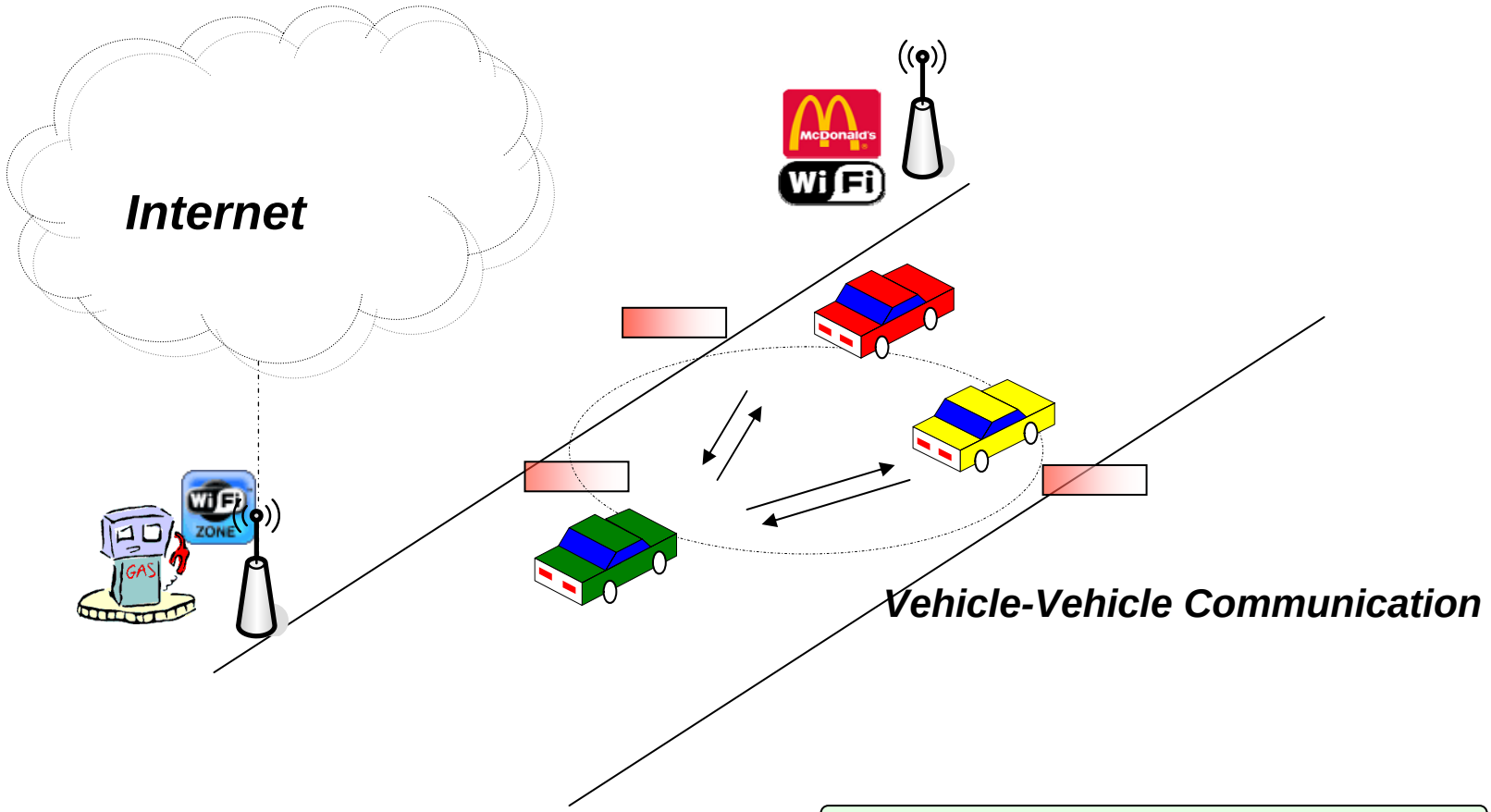


Vehicle type: Cadillac XLR
Curb weight: 3,547 lbs
Speed: 45 mph
Acceleration: **- 20m/sec^2**
Coefficient of friction: .65
Driver Attention: **No**
Etc.

Vehicle type: Cadillac XLR
Curb weight: 3,547 lbs
Speed: 75 mph
Acceleration: **+ 10m/sec^2**
Coefficient of friction: .65
Driver Attention: **Yes**
Etc.

Reference to Mario Gerla, "Wireless ad hoc networks: cross layer

Example (2): Co-operative Download



Exchanging Pieces of File Later

Reference to Mario Gerla, "Wireless ad hoc networks: cross layer opportunities"

Challenges in VANET

- Safety and non-safety applications
- Roadside-to-vehicle and vehicle-to-vehicle communication
- Communication protocol design
- Channel modeling
- Modulation and coding
- Power control and scalability issues
- Multi-channel organization and operation
- Security issues and countermeasures
- Privacy issues
- Network management
- Routing protocol and mobility management
- Simulation frameworks & real-world testbeds

Thanks!

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