Subject Index

ACC, see Adaptive Cruise Control evaluation
communication failure, 216
controller, 217
sensor robustness, 216
ADA, see Advanced Driver Assistance cooperative
ACC controller, 224
safety margin, 177
SUMMITS, 208
Balise, see also European Train Control System, 84
CDN, see Content Distribution Network, 265
Collision avoidance
Adaptive Cruise Control, 217, 218
cooperative, 119, 150
Positive Train Control, 135
Communication application
voice communication, 33
public safety
failure, 33
first responder, 30
GPS, 31
history, 30–31
inter-agency, 33
9/11, 31, 33
Wi-Fi locator, 31
traffic class
WiMAX, 184
Communication protocol
anonymous gossip, 70
Application Sub Layer, 162
ARIB STD-T88, 162
automotive message set, 159, 168
broadcast, 17, 18, 66, 85, 88, 158, 180, 220
reliable, 70
repetitive, 69
coeexistence, 266
compliance, 107
CSMA, 66, 240
DHCP, 76
FTP, 163
gecast, 12, 15, 17, 18, 20, 78
gographical addressing, 185
HTTP, 163
IEEE 1609.0, 159
IEEE 1609.1, 158, 174
IEEE 1609.2, 106, 109, 159, 174
IEEE 1609.3, 159, 174
IEEE 1609.4, 62, 65, 159, 174
IEEE 1609.5, 159
IEEE 802.11p, 240
IEEE 802.11
SyncScan, 237
ACK, 233
basic access procedure, 233
DeuceScan, 238
DIFS, 233
fast handover support, 228, 231–238, 240
OpportunisticScanning, 238
Post Transmission Buckoff, see PTB
PTB, 233
TBTT, 233, 237
TSF, 232
IEEE 802.11n, 178
IGMP, 194
IP, 18, 155, 163, 266
IPv6, 175, 186–187
6lowpan, 197
ulPv6, 197
ISA-SP100.11a, 196
MANET, 65, 76
MEXT, 176
MLD, 194
Mobile IP
   inter-agent handover, 196
Mobile IPv4, 175
Mobile IPv6, 176, 186–194
   multiple access networks, 190
   network mobility, 187
multicast, 85, 90, 194, 238
   acknowledged, 87, 181
   anonymous gossip, 71
NEMO, 76, 175, 176, 187–190
   Binding Update, 188
   flow identification, 190
   HA proxy, 193
   handover delay, 194
   multiple flow handover, 191
   RO security issues, 193
   RO solution space, 193
   Route Optimization, 191–194
PIM-SM, 194
   position-based, 111, 113, 186
   routing, 78
routing
   geographical, 185
   IP multicast, 194–196
   Route Optimization, 176
RTCP, 88
SAE J2735, 159, 168
security, 231
   IEEE 1609.2, 106, 109
spanning tree, 32
TCP, 12, 155, 163, 266
UDP, 12, 155, 266
unicast, 15, 17–19
WAVE stack, 174
Wireless HART, 196
WSMP, 11, 12, 15, 16, 18, 64, 186
Z-Wave, 196
ZigBee, 196
Communication system
   ad hoc
      MANEMO, 176
      MANET, 71, 176
   aggregated moving network, 176
   automotive
      ad hoc, 36, 161, 175, 178
      antenna patterns, 47–48
      ARIB STD-T75, 162
      DSRC, see Dedicated Short Range Communications, 2, 4, 5, 7, 26, 37,
implementation, 228, 239
automated toolchain, 243–244
C-code, 243–244
intra-macro-cell handover, 242–243
intra-micro-cell handover, 242
key postulates, 239
MAC scheme, 241–242
methodology, 243–244
performance evaluation, 245–252
predictive fast handover, 242–243
proof-of-concept demonstrator, 244–245
RBS, 244
SDL, 243–244
system architecture, 240–241
integration, see also interoperability, 38, 101–102, 125, 261
interoperability, see also integration, 35–37, 151–152, 175
protocols, 163
standardization, 151–152
MAC
centralized, 240
deterministic, 229, 240
hybrid, 229
SDU, 231
stochastic, 229, 240
synchronization, 231, 232
mesh network, 238, 253
IEEE 802.11s, 36
public safety, 32, 253
mobile AP
public safety, 31
mobile router
Mobile IPv4, 175
NEMO, 187, 190
public safety, 32
multi-radio, 36, 177, 190
multichannel coordination, 61
multiple control channels, 66
single control channel, 65
on-board
CAN, see Controller Area Network, 150, 155, 163, 196
Ethernet, 100
gateway, 101
IPTrain, 100
MVB, see Multifunction Vehicle Bus, 99
Profinet, 100
TCN, see Train Communication Network, 99–100
TORNAD, 84
TGV, 84
WTB, see Wire Train Bus, 100
PHY
synchronization, 231
public safety
ad hoc, 35
Extended Area Network, 38–40
group communication, 34
IEEE 802.11p, 39
Incident Area Network, 35–36
Jurisdictional Area Network, 36–38
packet data, 30
permanent infrastructure, 36
push to talk, 31
quick kits, 36
regional network integration, 39
trunking, 31, 34
vehicular relay, 31
railway
Airlink, 102
EIRENE, 97
GSM-R, 85, 96, 258
hard real time, 99
IAGO, 102
integration, 101–102
magnetic coupling technology, 93
MODCOMM, 102
on-board, 99–100
propagation model, 92
regulation, 93
satellite, 99
services, 88–91
soft real time, 100
train motion influence, 93
wireless link model, 92–93
wireless systems, 93–99
requirements
access delay, 229
delay, 231
Inter-Arrival Time, 229, 249
jitter, 229
location information, 229
packet loss, 231
packet reordering, 231
radio cell overlap, 237, 242
RSSI, 231, 237, 247
railway, 85–88, 229–230
Round Trip Time, 229
RFID, 175
safety
   beacon, 112
satellite, 99
   IRIDIUM, 30
   Teledesic, 30
security
   necessity, 122
security architecture, 106, 109–111, 116, 124
service interruption time, see handover delay
Software Defined Radio, 153
train to wayside evolution, 83–84
vehicular
   IEEE 802.11, 228, 232, 240, 253
wearable, 42
WiBree, 196
wireless
   3GPP LTE, 173, 181–184
   break-before-make handover, see hard handover
BSS association, 180
cost, 231
EDGE, 97
GPRS, 97, 176, 181, 258
GSM, 96, 181
handover, 230, 239
handover frequency, 230
handover phases, see handover taxonomy
hard handover, 183, 231
HSDPA, 98, 182
HSUPA, 98
LMR, see Land Mobile Radio, 36, 38
make-before-break handover, see soft handover
mobile WiMAX, 185
soft handover, 231
support for high user velocities, 230
UMTS, 98, 181
vertical handover, 183
virtual beacon, 181
Wi-Fi, 94, 155, 181
wide-area automotive, 181–185
WiMAX, 36, 38, 95, 173, 184–185

Cooperation
awareness, 119
cognitive, 267
collision avoidance, 119

V2I system
   performance criteria, 205
vehicle-driver, 204
vehicle-infrastructure, 204
vehicle-infrastructure system design problems, 204–205
human factors, 205
   human factors, 203, 204, 206, 208, 225
traffic flow, 203, 204, 206
vehicle-vehicle, 209
CR, see Cognitive Radio, 267
Credential certification
Certification Authorities cooperation, 117
Certification Authority, 106, 109, 116, 154
   multi-domain, 117
organizational concerns, 124
Pseudonym Provider, 111
   regional, 109
revocation, 117
self-certification, 113

DOD, see United States Department of Defense
   Strategic Rail Corridor Network, 130
DOT, see United States Department of Transportation, 21
ITS spectrum, 2
STB, see Surface Transportation Board internate commerce act, 144
   Transportation Technology Center, 137
DTN, see Disruption- and Delay Tolerant Network, 265
VANET, 265

EAN, see Extended Area Network, 38–40
   IEEE 802.16e, 38
   integration, 38
LMR, 38
Equipment certification
   military, 41

Future Internet
   Internet of things, 265
   Network symbiosis, 265
   Smart objects, 265
VANET, 265

IAN, see Incident Area Network, 35–36
   IEEE 802.11s, 36
   mesh network, 36, 238, 253
temporary infrastructure, 35
use cases, 35–36
VANET, 35, 40
IRSA, see Integrated Full-Range Speed Assistant controllers, 209–212
implementation, 219
scenarios, 209
ITS modeller, 204
JAN, see Jurisdictional Area Network, 36–38
IEEE 802.11, 36
IEEE 802.16e, 36
IEEE 802.22, 37
mesh network, 36, 238
permanent infrastructure, 36
MARS, see Multi-Agent Real-time Simulator, 204
Multi-Aspect Assessment approach, 204
NSA, see United States National Security Agency
information assurance technical framework, 139
OSI, see Open Systems Interconnection, 89, 138, 149, 154, 162
Performance evaluation
Access Point Transition Time, see APTT APTT, 245
application
cryptographic overhead, 116
application reliability, 69
cooperative system, 205
empirical results, 249–252
Inter-Arrival Time, 249
emulation
vehicular mobility, 247
IEEE 1609.4, 63
IEEE 802.11p, 58–61, 235
hidden terminal, 180
MAC, 180
OFDM, 59
Packet Error Rate, 178
traffic density, 181
transmission range, 179
IEEE 802.11
Access Point Transition Time, see APTT
APTT, 245
active scanning, 232–233
association, 232
authentication, 232
handover, 231–238
handover decision, 232, 237
joining a BSS, 232
link layer reestablishment, 232–235, 238, 253
network discovery, 232, 237–238
passive scanning, 232–233
radio system
channel switch time, 245
train communication
IEEE 802.16d, 95
train control
performance management, 144
security cost, 142
security indicator, 145
VANET
applications, 20
broadcast protocols, 69
broadcast reliability, 66
gossip protocol, 71
multichannel coordination, 64–65
NEMO, 76
packet drop burst, 67
packet drop rate, 67
packet loss, 64
Positioning
ERTMS, 102
GNSS, 119
CALM, 175
Doppler shift, 121
forged signal, 119
GPS, see Global Positioning System
PTC, 134, 144
public safety, 31
VANET, 23
vehicular communication, 23, 151, 210, 214
radar
vehicular communication, 215
railway infrastructure, 229
signal indications, 132
track database, 144
SCADA
Communications-Based Train Control, 229
PTC, 132, 229
Wi-Fi locator
  public safety, 31

Privacy
  anonymity, 108
  strong, 108
  attack, 106
  identity linking, 108
  cost reduction, 115–116
  enhancing technologies, 106, 113–116
  identity
    disclosure, 108, 109, 114
    identity concealment, 108
  position, 122, 229
  pseudonym, 111, 113–117, 121–123
    Baseline Pseudonymous
      Authentication, 113
      basic security, 111
    Hybrid Pseudonymous
      Authentication, 114, 122
      lifetime, 115
      short term identity, 117

Radio channel measurement
  point of acquisition
    local, 231
    remote, 231
  positional reference
    differential GPS, 51
  reference clock
    Rubidium frequency standard, 51
  signal waveform
    analysis, 51
    generation, 51
    recording, 51

Radio propagation, see V2X radio channel

Radio system
  antenna
    directive, 47, 48, 77, 178
    eigen-beamforming, 178, 183
    MIMO, 182, 184
    mismatch, 31
    mount, 47, 49
    multiplexing, 183
    satellite, 99
    size, 92
    spatial multiplexing, 184
  channel access
    deterministic MAC, 229
    FDD, 98, 162
    hybrid MAC, 229
    stochastic MAC, 229
    TDD, 98, 184
    TDMA, 37, 162
  Channel State Information, 183
  IEEE 802.11p, 178
    baseband, 178
    PHY layer, 179
    interference mitigation, 182
    mobility
      performance impact, 182
  modulation
    BPSK, 158
    CDMA, 31
    cyclic prefix, 59
    Doppler resistance, 179, 183
    DSSS, 51, 56
    OFDM, 51, 59, 95, 158, 179, 180, 182, 184
    OFDM mid-amble, 180
    pilot-carrier, 60–61
    QPSK, 158
    Scalable Adaptive Modulation, 37
    SOFDMA, 95
    sub-carrier, 59, 60, 179, 184
    WCDMA, 98
    multi-user diversity, 183
    performance
      channel switch time, 245
      radio channel
        equalization enhancements, 61
      spatial multiplexing
        3GPP LTE, 182
        WiMAX, 184
      symbol period, 56
      temporal diversity, 183

Regulation
  performance-based, 138
  prescriptive-based, 138
  spectrum
    automotive, 2, 152
    DTV transition, 36, 152
    global harmonization, 164, 165
    global variation, 163
    public safety, 36
    public safety channels, 37
    railway, 93
    TV bands, 36, 162, 174
    WRC/RRC, 93, 167

Regulatory authority
  FCC, 2, 10, 38, 93, 154, 158, 173
  ITU-R, 46, 165
  WRC/RRC, 93, 165
SCADA, see Supervisory Control and Data Acquisition
Communications-Based Train Control, 129, 229, 236, 239, 253
handover requirements, 229–230, 236, 239, 242, 253
Communications-Based Train Control, 228
Digital Control Systems, 129
Positive Train Control, 129, 132, 229
handover requirements, 229–230
wireless, 132
SDR, see Software Defined Radio, 51, 153, 231, 266
CR, 266
GPS adversary, 119
Security
attack
active, 140, 142
adversary, 107
branding, 118
close in, 140
collusive, 107
denial of service, 140
distributed, 142
distribution, 107, 140
external, 107
false information, 106
false position, 119
IATF classification, 139
identity linking, 114
identity theft, 140, 142
insider, 140
internal, 107
jamming, 140
mal-actor, 106, 107, 142
malicious association, 140
man in the middle, 140
message forge, 107
message inject, 107
message replay, 107
mitigation, 108, 141
passive, 139
passive adversary, 107
relay, 112
replay, 112
rogue protocol, 107
sensor adversary, 108
tracing, 108
vehicle tracking, 122
attack detection
distributed, 118
forged GNSS messages, 121
attribute
accountability, 142
authenticity, 108, 141
availability, 141
confidentiality, 108, 141
identification, 142
integrity, 108, 141
authentication
anonymous, 114
data origin, 142
Group Signature, 114
certification
certificate period, 115
domain, 109
Foreigner Certificate, 117
private key, 106, 107, 110–112, 114, 117, 118, 123
public key, 106, 110–112, 114, 116, 117, 121, 122
revocation, 116–118, 123
cost reduction, 115–116
cryptographic
cost reduction, 115–116
cryptographic overhead
system performance, 116
data centric, 106, 119
encryption, 89, 96
elliptic curve, 122
military, 41
key management, 109
level
classification, 123
location information, 119–121, 229
mal-actor, 138
military
IEEE 802.11i, 41
non-cryptographic, 108
requirements, 108–109
access control, 108
application, 109
authentication, 108
authorization, 108
entity association, 232
textbook authentication, 108, 232
importance, 109
non-repudiation, 108
revocation list, 117, 121, 123
encoding, 118
Fountain codes, 118
Raptor codes, 118
robustness, 115
secure VC deployment, 124
sensor adversary, 119
non-cryptographic protection, 119
thread model, 107–108
trust establishment
data centric, 122
trustworthiness
assessment, 121
communication module, 123
data, 109, 119
level, 121
message, 121, 142
message sender, 119
position information, 120
sender, 108, 121, 142
system, 124
Sensing
infrastructure-based, 177
Simulation
driver model, 225
driving, 207
IEEE 1609.4
multichannel MAC, 64
intelligent vehicle
SUMMITS, 214–215
microscopic traffic
SUMMITS, 207
performance evaluation
multichannel MAC, 63
system robustness
MARS, 212
traffic flow
ITS modeller, 218
scenarios, 221–224
throughput optimization, 208, 224
traffic model, 224
traffic pattern, 224
VANET
information dissemination, 74
safety applications, 24
VANET performance limits, 3
vehicle model, 225
Spectrum
allotment
DSRC, 46
digital dividend, 259
DSA, see Dynamic Spectrum Access
dynamic access, 259
license by rule, 173
license-exempt use, 93
licensing
exclusive, 93
V2I, 160
licensing cost, 38
spectrum handover, 266
whitespace, 259
Standardization
automotive
ASTM, 157
C2C-CC, 161, 175
COMeSafety, 161
ETSI ITS, 161, 172, 173
Europe, 160–162
global, 163–168
global organizations, 164–168
IEEE WAVE, 65, 77, 109, 158–160,
165, 167, 174, 178, 235
ISO CALM, 161, 164–165, 167, 174,
176, 187, 191
ISO TC 204, 164
ISO TC 22, 164
ITU-T APSC TELEMOV, 167
Japan, 162–163
North America, 157–160
regional differences, 167
regional progress, 157–163
cooperation, 156–157
motivation, 156
protocol layers, 156
insufficiency, 154
interoperability, 38, 150, 154
security, 154
military
FIPS-140, 41
necessity, 153
message set, 153
radio, 153
rules of use, 154
protocols
activities, 155
OSI model, 154–155
railway
  IEC TCN, 99, 100
  regional aspects, 152
Standardization body
  ARIB, 46, 162–163
  CEN, 160
  CENELEC, 161
  ETSI, 93, 161, 172, 175
  IEC, 100, 161
  IEEE, 155
  IETF, 155, 175, 186
  ISO, 100, 155, 160, 164, 174
  ITU-R, 165
  ITU-T, 167
  NIST, 41
  SAE, 159
  TIA, 37
  UIC, 96
SUMMITS, see Sustainable Mobility
  Methodologies for Intelligent Transport Systems
  assessment
    meta-model, 206, 207
    multi-aspect, 205
    speed assistant, 208–212
  IRSA, 208–212
    impact on traffic flow, 218–219
    implementation, 213–215, 219–221
  ITS modeller, 218
  MARS, 213–215
  tool-suite, 206
    overview, 204
    tools, 206–207
Testing
  cooperative system
    scenarios, 177
  on-road
    SUMMITS, 207
  security
    challenges, 125
TNO, see Netherlands Organization for Applied Scientific Research
SUMMITS, 204
Traffic Control System
  train control
    cab signal system, 132
  train operations
    Direct Traffic Control, 131
    Track Warrant Control, 131
    centralized, 131
  mandatory directives, 131
  operating rules, 130, 131
  verbal authorities, 131
Traffic management
  automotive
    protocol, 158
  rail traffic
    ERTMS, 85, 101, 173
Train control
  PTC, see Positive Train Control
    OSI application layer protocol, 138
    accounting management, 145
    architecture, 134–135, 240–241
    central office, 135
    configuration management, 145
    fault management, 145
    full system, 133
    functional levels, 133, 229
    on-board subsystem, 134
    overlay system, 133
    performance management, 144
    security management, 146
    track database, 144
    wayside subsystem, 135
Train control system
  ATC, see Automatic Train Control, 84, 88–89, 94, 132
    full ATC, 89
  ATP, see Automatic Train Protection, 88
  Automatic Train Stop, 132
  ETCS, see European Train Control System, 85, 102, 258
  Eurobalise, 102
  Euroloopt, 102
  MODURBAN, 102
  PTC, see Positive Train Control
    Advanced Civil Speed Enforcement System, 136
    Collision Avoidance System, 136
    Communications-Based Train Management, 136
    Electronic Train Management System, 136
    Incremental Train Control System, 136
    North American Joint Positive Train Control System, 136
    operational in the US, 135–138
    Optimized Train Control, 136
    Train Sentinel, 136
    Vital Train Management System, 136
speed control
  KVB, 84

UIC, see Union Internationale des Chemins de Fer, 96

V2I, see Vehicle-to-Infrastructure communication
  3GPP LTE, 173, 181–184
  3GPP LTE beyond, 259
  EDGE, 98
  GPRS, 97, 98, 118, 181
  GSM, 97, 98, 181
  HSDPA, 182
  IMT-Advanced, 259
  IP-based, 186–196
  mobile WiMAX, 184
  non-IP, 185–186
  radio channel, see also V2X radio channel
  V2I fading model, 50
  UMTS, 98, 118, 182, 183, 187
  WiMAX, 173, 184
  IEEE 802.16e, 184
  IEEE 802.16m, 184

V2X, see Vehicle-to-Vehicle/Infrastructure communication
  C2C-CC, 175
  collaboration and cooperation, 265–267
  IP-based group communication, 194
  radio channel, 48–57
    absorption, 50
    characteristics, 179
    coherence bandwidth, 57, 179
    coherence time, 54, 60, 179
    delay spread profile, 56
    deterministic model, 48
    diffraction, 50
    Doppler spread, 53, 59
    Doppler tracking, 180
    dual slope log-normal model, 49, 51
    effective velocity, 56
    equalization, 59, 60, 77, 179
    estimation, 179, 180, 182
    fading statistics, 53
    frequency selective fading, 57
    geometry-based model, 48
    impact of driver behavior, 55
    impact on OFDM, 59
    inter-carrier interference, 183
    large-scale model, 50, 53
    large-scale path loss, 51

measurement system, 51
measurements, 51, 231
multi-tap model, 50
multipath fading, 48–50
railway, 92
ray-tracing, 48
scattering, 50
small-scale fading model, 49
sounding, 51, 182
time-dispersive, 50
two-ray flat-earth model, 48
V2V fading model, 50
V2V channel properties, 51
VANET, see Vehicular Ad hoc Network, 4, 161

application
  neighbor table, 113
  safety beacon, 112
  security, 109
application characteristics, 8–10
  event correlation, 10
  event detection, 10, 13
  event lifetime, 9
  information recipients, 9, 13
  participants, 9
  Region-of-Interest, 9, 13
  trigger condition, 9, 13
user benefit, 8
application characterization, 12–18
  by application characteristics, 12–15
  by network attributes, 15–18
application classification, 18–21
  content download/streaming, 19
  short message communication, 18
application reliability, 68–69
  metric, 69
broadcast
  broadcast storm, 71
  contention-based, 72
  flooding, 72
  reliability, 66–68
  sparse VANET, 73
certificate revocation
  RSU distributed, 117
  vehicle distributed, 118
deployment
  aftermarket, 22
  applications, 24
  infrastructure, 25
  market centric, 124
  market penetration, 23
navigation, 21
penetration, 21
rollout options, 21–23
safety applications, 24
standalone system, 21
system rollout, 25
telematics, 22
vertical market, 33
military
security, 41
UAV, 41
use cases, 40–41
multi-hop, 7, 20, 24, 41, 71–73, 78, 111, 161
network attributes, 10–12
broadcasting, 12
channel, 10
information lifetime, 11
infrastructure, 11, 17
message format, 11, 15
message transport, 12
message trigger, 12, 17
routing protocol, 11, 15
security, 12, 231
protocol
DHCP, 76
information dissemination, 71, 185
MANET, 76
mobile IP, 75–77
NEMO, 76
public safety
use cases, 35, 39–40
reliability enhancement
broadcast, 69
routing
Ad hoc On Demand Distance Vector Routing (AODV), 74
Dynamic Source Routing (DSR), 74
epidemic, 73
geographical, 185
geographical message forwarding, 113, 186, 259
geographical packet forwarding, 113, 186, 259
security, 113
security
neighbor discovery, 112–113
routing, 113
VC, see Vehicular Communication
application vs. communication
reliability, 67, 69, 230
CR, see also Cognitive Radio, 266
cryptographic overhead, 116
evolution, 259, 265
Internet of things, 265
Machine-to-machine communication, 265
military, 40–42
mobile WiMAX, 185
public safety, 31–34
challenges, 35
homeland security, 35
traceability, 125
VoIP, 30
SDR, 266
security
legal considerations, 125
policies, 125
traffic class
non real time message data, 86
real time data, 85
streaming data, 88
Wi-Fi
Access Point Transition Time, see APTT
handover delay, 95, 237, 239
APTT, 245
service interruption time, see handover delay
wireless sensor network, 196–198, 265
low power, 198
on-board, 196
VC application, see also VSC application
Amber alert, 37
audio streaming, 90
automated tolling, 6, 158, 161
benefit, 5–7
classification
content download/streaming, 19
short message communication, 18
commercial, 5, 7
cconvenience, 5, 6, 151
DTV transition, 162, 259
electronic report, 30
enhanced navigation, 158
future Internet, 265
information displays, 89
information sharing, 40
integrated detection systems, 40
Internet access, 91
large-scale device monitoring, 194
maintenance, 91
PIS, see Passenger Information System, 89–91
position-based, 119, 163
predictive maintenance, 84
rapid deployment, 40
remote diagnostic, 196
remote repair, 196
remote situation analysis, 37
Seat Reservation Display, 89
software update, 91, 194, 196
surveillance, 32
traffic management, 5, 158, 177
train management, 136
transportation efficiency, 6
VANEMO, 76
VANET, 109, 122
vehicle tracing, 40
video streaming, 32, 90
VoIP, 30–32, 37
VeHIL, see Vehicle Hardware In the Loop, 207
VSC, see Vehicular Safety Communication
packet loss, 181
WiMAX
safety message latency, 185
VSC application, see also VC application
CCTV, 90
Basic Safety Message set, 159
collision avoidance, 136, 158
cooperative awareness, 119, 177
crash avoidance, 150
driver assistance, 5
intersection collision avoidance, 151
malfunction identification, 196
road safety, 177
soft safety, 151
speed control, 84
speed enforcement, 136
traffic safety, 150
train control, 136
VANET, 63, 68
vehicle safety, 5