## Index

Note: Figures and Tables are indicated by *italic page numbers*, terms in glossary by *emboldened numbers*

<table>
<thead>
<tr>
<th>Term</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G networks</td>
<td>7, 13, 118</td>
</tr>
<tr>
<td>4G networks</td>
<td>7–8</td>
</tr>
<tr>
<td>ABDIAS</td>
<td>137, 138, 142</td>
</tr>
<tr>
<td>access selection algorithms, executing</td>
<td>120, 122, 124</td>
</tr>
<tr>
<td>accounting system (in market exchange applications)</td>
<td>281</td>
</tr>
<tr>
<td>ACS (Ambient Control Space)</td>
<td>118–19, 124</td>
</tr>
<tr>
<td>ad hoc network services</td>
<td>8–13</td>
</tr>
<tr>
<td>ad hoc networks</td>
<td>7, 35</td>
</tr>
<tr>
<td>cooperative relaying in</td>
<td>11–12</td>
</tr>
<tr>
<td>limitations in</td>
<td>16–19</td>
</tr>
<tr>
<td>ad hoc wireless network model</td>
<td>154–5</td>
</tr>
<tr>
<td>adaptive cooperation throttling</td>
<td>224</td>
</tr>
<tr>
<td>adaptive DF relaying</td>
<td>23, 26, 27</td>
</tr>
<tr>
<td>adaptive modulation</td>
<td>28</td>
</tr>
<tr>
<td>adaptive repartitioning, CMP cooperative caching for</td>
<td>259–62</td>
</tr>
<tr>
<td>adaptive selective replication</td>
<td>224–5, 256, 261</td>
</tr>
<tr>
<td>adaptive spilling</td>
<td>260–1</td>
</tr>
<tr>
<td>ADCR (adaptive distributed cross-layer routing) algorithm</td>
<td>14</td>
</tr>
<tr>
<td>additional delay, in cooperative-diversity system</td>
<td>29–30</td>
</tr>
<tr>
<td>address-centric approach to routing</td>
<td>44</td>
</tr>
<tr>
<td>admission control and negotiation protocols (in utility grid)</td>
<td>280</td>
</tr>
<tr>
<td>AF (Amplify-and-Forward) relaying strategy</td>
<td>22, 26, 196, 307</td>
</tr>
<tr>
<td>power allocation under</td>
<td>201–3</td>
</tr>
<tr>
<td>AFM (associated feedback mechanism)</td>
<td>10</td>
</tr>
<tr>
<td>AI (artificial intelligence) techniques</td>
<td>41</td>
</tr>
<tr>
<td>Alamouti scheme(s)</td>
<td>24–5</td>
</tr>
<tr>
<td>alert clustering</td>
<td>138, 307</td>
</tr>
<tr>
<td>alert correlation</td>
<td>137, 142, 307</td>
</tr>
<tr>
<td>ALPACAS</td>
<td>137, 138, 143</td>
</tr>
<tr>
<td>Ambient Networks architecture</td>
<td>118–19</td>
</tr>
<tr>
<td>ACS (Ambient Control Space)</td>
<td>118–19, 124</td>
</tr>
<tr>
<td>functional entities</td>
<td>119, 121–2</td>
</tr>
<tr>
<td>HOLM (Handover and Locator Management) FE</td>
<td>121, 124–5</td>
</tr>
<tr>
<td>Path Selection FE</td>
<td>122, 124</td>
</tr>
<tr>
<td>TRG (Triggering) FE</td>
<td>121, 124</td>
</tr>
<tr>
<td>interfaces</td>
<td></td>
</tr>
<tr>
<td>ANI (Ambient Networks Interface)</td>
<td>119</td>
</tr>
<tr>
<td>ARI (Ambient Resource Interface)</td>
<td>119</td>
</tr>
<tr>
<td>ASI (Ambient Service Interface)</td>
<td>119</td>
</tr>
<tr>
<td>MRA (Multi-Radio Access) architecture</td>
<td>119</td>
</tr>
<tr>
<td>GLL (Generic Link Layer)</td>
<td>119, 120, 123</td>
</tr>
<tr>
<td>MRRM (Multi-Radio Resource Management)</td>
<td>119, 120, 122–4</td>
</tr>
<tr>
<td>ANC (Analog Network Coding)</td>
<td>194, 307</td>
</tr>
<tr>
<td>anchor-based routing strategy</td>
<td>61</td>
</tr>
<tr>
<td>anchors (reference nodes)</td>
<td>39</td>
</tr>
<tr>
<td>ANI (Ambient Networks Interface)</td>
<td>119</td>
</tr>
<tr>
<td>ANNs see artificial neural networks</td>
<td></td>
</tr>
<tr>
<td>anomaly-based IDSs</td>
<td>135</td>
</tr>
<tr>
<td>antenna array gain</td>
<td>21</td>
</tr>
<tr>
<td>AoA (angle of arrival) methods</td>
<td>38, 39, 307</td>
</tr>
<tr>
<td>AP (Access Point) coverage zone</td>
<td>68</td>
</tr>
<tr>
<td>application layer</td>
<td>148, 178, 179</td>
</tr>
<tr>
<td>application layer multicast systems see also ChunkySpread . . . ; CoolStreaming . . . ; mTreebone performance evaluation of</td>
<td>92–8</td>
</tr>
</tbody>
</table>
APST (AppLes Parameter Sweep Template) 297, 300
ARI (Ambient Resource Interface) 119
ARQ protocol delay 164–5
ARQ schemes 14, 149 see also Cooperative ARQ; Delayed Cooperative ARQ; Node Cooperative Stop-and-Wait . . . scheme
artificial neural networks (ANNs) 50–2, 308
applications 50
feed-forward ANN 51
recurrent ANN 51, 52
in WAdSNs 41, 52
artificial neuron 50–1
ASI (Ambient Service Interface) 119
ASR (Adaptive Selective Replication) 224–5, 256, 261
auction market models 279, 286–7
authentication 16
authentication and access control, in vehicular networks 67–9
autocorrelation, of fading process 150
AutoSec middleware 48
availability 16
average delay
of NCWS scheme 165, 172, 173
of retransmission protocol 153
of SW scheme 154, 172, 173
AWGN (Additive White Gaussian Noise)
channel model 150, 195, 308
Shannon capacity under 197–8
axis nodes (in DOMINO system) 139, 140

BAF (Bursty Amplify-and-Forward) strategy 197, 206, 308
bargaining models 286
Bellagio 290, 292
BER (bit error rate), in cooperative-diversity systems 25, 27
best-relay selection 23, 29, 308
bidding/valuation mecanism 279
bio-inspired devices 52
Bot-master 134
Botnets 134, 308
detection of 137, 138, 144
Bot-nodes 134
broadcast, compared with multicast 78–9
broadcast networks 7
broadcast signaling 184
broker(s) 279, 308
BS (Base Station) coverage zone 68
bundle 101, 106, 308
bundle layer 101–2, 106
butterfly networks 192, 193, 209
C-DIV 12
cache coherence see also CCE extensions 235, 238–9
cache coherent private caches 239–40
cache inclusion 230
cache partitioning schemes 223, 225–6
cache placement based cooperation 232–3, 250
cache replacement 221, 240, 253
cache replacement based cooperation 233, 250
caching 217 see also proxy caching
CAIA 11
calibration 308 see also SLC
in wireless sensor networks 36, 40
capacity gain, in cooperative-diversity systems 28
CatNet 290, 293–4
CC (complete complementary) codes 195, 308
CC see cooperative caching
CCA (cooperative cache agent) 9
CCA (Cooperative Collision Avoidance) 57–8
CCD (cooperative cache daemon) 9
CCE (Centralized Coherence Engine) 235–9
compared with DCE 246–8
structure 244, 245
CCP (Cooperative Cache Partitioning) 252, 266–8, 309
algorithm 267–8
evaluation of 268–9
CCS (Computing Centre Software) 297, 298
CCSL (Cooperative Cache Supporting Library) 9
CCW (Cooperative Collision Warning)
applications 65–6
CDDHT (Cyber Disease Distributed Hash Table) 138, 143
CDMA (Code Division Multiple Access) 198, 309
CDNs (Content Delivery Networks) 77, 80
CDP (Cell Density Packet) 71–2
CEDAR algorithm 9
cellular networks 7, 13–14, 154
Central Coherence Engine see CCE
CF&F (cooperative freight and fleet)
applications 70
CF (Compress-and-Forward) relaying strategy 197, 201, 309
CFPs (Contention-Free Periods) 38
channel estimation, in cooperative-diversity systems 31
chip multiprocessors 218 see also CMP
corner-based organization 235–9
cooperative caching for applications 251–69
framework 227–9
implementations 234–41
mechanisms 229–34
large-scale CMPs
correlative caching for 241–3
distributed cooperative caching for 243–8
ChunkySpread multicast system 92
compared with mTreebone 92–3
CIDN see Cooperative Intrusion Detection Network
CINT (cooperative inter-urban) applications 70
CIS (Cognitive Information Service) 181, 183
CITRA 10–11
clean data, sharing among private caches 231, 238
cluster-based CMP organization 235–9, 250
clustering approach to self-organization 67
CMP cache partitioning schemes 223, 225–6
CMP caching
challenges 218–20
destructive inter-thread interference 219
diverse workload characteristics 219–20
off-chip bandwidth limitations 218–19
on-chip wire delay 219
evaluation of various schemes (CC, CCP, MTP) 268–9
private cache based proposals 224–5
shared cache based schemes 223–4
taxonomy of hardware proposals 226, 227
CMP cooperative caching
applications 251–69
for adaptive repartitioning 259–62
for cache performance isolation 262–9
for memory latency reduction 252–8
framework 227–9
implementation layer 229
mechanism layer 229
policy layer 229
mechanisms 229–34
cache placement based cooperation 232–3
cache replacement based cooperation 233
cooperation mechanisms 231–3
inter-cache data sharing 231
non-inclusive caches 230
private cache organization 229–30
throttling mechanisms 229, 234
CNC (Cooperative Network Coding) 206–14, 309
COCA (Cross-Layer Cooperative Caching) middleware 48
coded-cooperation strategy 196–7, 309
cognition 125–7
cognitive adaptation algorithms 182
cognitive engine 180
cognitive plane 182
cognitive radio 126, 177
cohere engine 235–9, 309
collision, in wireless sensor networks 37
combinatorial, in wireless sensor networks 287, 292
combining techniques 309
in cooperative-diversity systems 23–4
commodity market model 279, 285
grid middleware for 295, 301
communication protocols, layers in stack 147, 148, 178–9
communities (neighbourhoods) 142
COMO (Cooperative Monitoring) 70
computer virus 133–4, 309
Condor-G 297, 299
confidentiality 16
consumer side requirements (for utility grids) 279–80
contention-based MAC mechanisms 37, 164
continuous SLC 39
Contract-Net 285
control overhead, mTreebone compared with other multicast systems 97
control packet overheads 37
control planes
between Ambient Networks 119
in DTN-based networks 101, 102, 106, 108
convergence 8
CoolStreaming multicast system 84, 92
compared with mTreebone 92–3
coopetition 309
benefits 7
in delay-tolerant networks 103–5
in intrusion detection networks 136–8
limitations 15–19
in vehicular networks 59–67, 69–73
in WAdSNs 35–53
coopetition-and-negotiation plane 181
coopetition groups 154–5
coopetition policies (in CMP coopetitive caching) 227, 228, 232, 242, 252–5
coopetition strategies 196–206
performance measures for 197–206
cooperation strategies (continued)
  in high-SNR regime 198–203
  in low-SNR regime 203–6
cooperation throttling 229, 234
  probability-based 234, 255–7
  quota-based 234, 241, 268
  supporting 241
cooperative area routing 69
Cooperative ARQ (C-ARQ) scheme 105
cooperative beamforming technique 25, 309
cooperative cache partitioning 252, 266–8, 309
  see also CCP
cooperative caching 220–1, 309
  centralized on-chip directory for 235–9
  functional requirements 234–5
  motivation for 220
  unique aspects 220–5
    non-uniform latencies 221–2
    online cache replacement and placement 221
    shared resource management 222–3
cooperative communication(s) 191, 208
cooperative diversity 21, 309
cooperative-diversity system(s)
  benefits 25–8
  combining techniques in 23–4
  limitations and challenges 28–32
  other cooperating techniques 24–5
  relaying techniques in 22–3
  simplified model 22
cooperative flexible lane allocation 70
cooperative intrusion detection networks 136–8
  classification of 138
  cooperation scope 137
  cooperation technologies and algorithms
    137–8
    data correlation 137–8
    load balancing 138
    trust management 138
    cooperation topology 136–7
    examples 138, 139–44
    specialization 137
cooperative local traffic control 69–70
cooperative network coding 206–14, 309
  see also cooperative network coding
cooperative network management 69
cooperative optimization architecture 179–81
cooperative optimization design 181–4
  inter-layer optimization 181–2
  inter-node optimization 183–4
cooperative proxy caching 81
cooperative relaying 11–12, 195–6, 309
  delay optimization in 13–14
cooperative relaying network service 13–15
cooperative sensor networks 12
cooperative space-time coding (STC) 24–5
core middleware 282, 283, 302
Cougar middleware 47
coverage improvements, in cooperative-diversity systems 28
CQoS (cooperative quality of service) 9–10
CR (cognitive radio) 126
CRACCA (Cluster-based Risk-Aware Cooperative Collision Avoidance) scheme 60
CRC (Cyclic Redundancy Check) code 196–7, 310
CRIM 136, 137, 138, 142–3
CRRM (Common Radio Resource Management) 125
cryptographic data 17
CSF (Community Scheduler Framework) 296, 297, 298
CSI (channel state information) 24, 25, 31, 197, 310
CSMA (Carrier Sense Multiple Access) protocol 179
CSP (Cluster-based Self-organizing Protocol) 67
CTA (Cooperative Travelers Assistance) 70
CURB (cooperative urban) applications 69–70
currency management 281–2
CVIS project 69–70
data aggregation 37, 41, 44–5, 310
data caching 8–9
data-centric approach to routing 44
data fusion 38, 43–5
data integrity 10
data link layer 148, 152
data loss rate 92
  mTreebone compared with other multicast systems 93–4, 96, 97
data plane, in DTN-based network 101–2, 106, 108
DCE (Distributed Coherence Engine) 243–4
  compared with CCE 246–8
  performance and power evaluation 248
  replacement policy 245–6
  structure 244, 245
DDF (Dynamic Decode-and-Forward) relaying strategy 195, 200, 310
DDoS (Distributed Denial of Service) attacks 134
delay jitter
  of NCSW scheme 165–8, 172, 173
  of retransmission protocol 153
  of SW scheme 154, 173
delay optimization 13–14
delay-tolerant networks 101, 102–5, 310
  application domains 103
  characteristics 101
  cooperation in 103–5
Delayed Cooperative ARQ scheme 105
destructive inter-thread interference 219
prevention of 225–6
DF (Decode-and-Forward) relaying strategy 23, 196–7, 310
  power allocation under 201–3
Dijkstra’s algorithm 41–2
directivity gain 21
disaster recovery networks 103
distributed architectures 126–7
distributed attacks 134
Distributed Coherence Engine see DCE
Distributed Cooperative Caching 243–8, 310
distributed sensor networks 191–2
Distributed Space Time Coding 156
diversity 310
  diversity gain 21, 25, 156, 191, 195, 198–9, 208, 310
  diversity order 23, 26
DMT (Diversity–Multiplexing Tradeoff) 197, 310
  optimal curve 199–200
  for various cooperative strategies 200
DOMINO IDS collaboration system 137, 138, 139–40
DOMINO mechanism (for greedy sender problem) 69
Doñana National Park (Spain) 44–5
DoS (Denial of Service) attacks 11, 17, 69, 133–4
double-sided auctions 287–8
DSDV (Destination Sequence Distance Vector) protocol 9
DShield 136–7, 138, 140
DSR (Dynamic Source Routing) protocol 9
DSRC (Dedicated Short-Range Communication), CCW applications 66
DSS (Dynamic Set Sampling) 256
DSWare middleware 48
DTNs see delay-tolerant networks
Dutch Auction 287
duty cycle 37–8, 311
EBD (Doñana Biological Station) 45
ECC (Elastic Cooperative Caching) 311
EDA (Enhanced Driver Awareness) 70
EGC (Equal Gain Combining) technique 23–4, 311
Elastic Cooperative Caching 259–60, 311
eNanos grid resource broker 297, 299–300
English Auction 287
envelope fading 149–50
Epidemic routing protocol 104, 108
  performance assessment of 105, 109–10, 112
episodic networks 101
  ergodic capacity 197–8, 311
error propagation 23
  event-triggered SLC 39
external attacks 17–19, 67, 133–5
  on vehicular networks 67
  prevention against 68–9
external SLC 39
fading 22, 25–6
fading channels, modeling of 149–52
fading margin 169
Fair Speedup metric 263, 269
  fairness 219, 227, 262
  fairness improvement 225, 252, 264
fast-flux service networks 135, 144
faulty sensor node (attack) 17
FDMA (Frequency Division Multiple Access) 195, 311
FEC (Forward Error Correction) 172
FFCIDN 138, 144
FIPA (Foundation for Intelligent Physical Agents), architecture for MAS 50
First Price Sealed Bid Auction 287
flood attack 19
flooding strategies 103
forwarding strategies 103
FTSP (Flooding Time Synchronization Protocol) 40
full-duplex transmission 25, 30, 195, 311
G-Commerce 291, 296
game theory 284
gateway discovery 62–3
genetic algorithms 52
GLL (Generic Link Layer) 119–20, 123
global detectors (in worm detection system) 141
Globus 10, 280, 296, 297, 298–300
GNT (Global Network Time) 40
Go Back N retransmission protocol 154, 155
gossip algorithms 86
Gossip (worm detection system) 137, 138, 141–2
gps (Global Positioning System) applications 39, 60
graph theory 41
GRIA 291, 295–6
grid computing 277, 278, 311
grid exchange middleware 282, 283
grid fabric 282, 283
grid market exchange 277–8
grid market exchange services 278–9, 292
grid networks, data integrity in 10
grid resource 311
  commoditization of 280
  estimation of usage 280
grid resource management systems 280
  market-oriented systems 289–96
  system-oriented schedulers 296–300
GridBus Broker 291, 294, 301
GridEcon 291, 295
Gridway 297, 298, 301
GRUBER/DI-GRUBER 297, 299
GSC (Generalized Selection Combining) technique 24
GVI (Geo-localized Virtual Infrastructure) 63–5
GyTAR (improved Greedy Traffic Aware Routing) protocol 61–2
half-duplex transmission 30, 195, 311
ham mails 143, 311
HBCIDS 136–7, 138, 143
heterogeneous wireless networks 7
  cooperation in 117–18
heterogeneous wireless resources, management of 120–1
high-degree-preemption algorithm, treebone optimization by 89, 90
HOLM (Handover and Locator Management) functional entity 121, 124–5
host-based IDS (HIDS) 135, 136, 139, 143
HRS (hybrid reputation system) 10
HWN (hybrid wireless network), resource sharing for 14–15
hybrid protocols 9
hybrid-ARQ scheme 172, 174
ICMP (Internet Control Message Protocol) 184
identity theft 133–4
idle listening 37, 311
IDS see intrusion detection system
IEEE 802.11 MAC protocol 164
IEEE 802.11 networks 9–10, 14, 155
IEEE 802.11i authentication model 68
IEEE 802.15.4 protocol 37, 45
IEEE 802.21 working group 118, 121
IEEE 802.22 working group 126
IFTIS (Infrastructure-Free Traffic Information System) 71–3
IMPALA middleware 48, 50
implementation complexity, in
  cooperative-diversity systems 30–2
in-band signaling 183
incremental relaying 23, 29, 311
Indra IDS 136–7, 138, 139
information gathering (attack) 17
information and market directory (in utility grid) 280–1
injection (attack) 17
insurrection (attack) 17
integrity 16
Intelligent Transportation System 71
inter-frame spacing mechanism 164, 165
interim channel 158, 159
inter-layer cooperative optimization 181–2
intermittently connected networks 101
internal attacks
  on vehicular networks 67–8
  prevention against 69
internal SLC 39
Internet media streaming
  application end-point architecture 80–82
  architectural choices for 78–82
  infrastructure-centric architecture 80, 81
  peer-to-peer applications 82–98
  with proxy caching 80
  router-based 79–80
Internet protocol 101
Internet protocol stack 148
inter-node cooperative optimization 183–4
interplanetary networking 103, 112
intrusion analysis 11
intrusion detection networks see also cooperative intrusion detection networks
  cooperation in 136–8
  examples 138, 139–44
intrusion detection systems 11–12, 18, 135–6
types 135–6
IP Multicast architecture 77, 79–80, 312
I2V (Infrastructure-to-Vehicle) architecture 58
Java Market 291, 295
JDL (Joint Directors of Laboratories), data fusion model 43, 45
JRRM (Joint Radio Resource Management) 125
Kerberos authentication model 68–9
legal support (in utility grid) 282
link improvement 25–6
link layer 148, 152, 179, 179
link layer retransmission 148, 153
load-balancing algorithms (for IDSs) 138
local detector (in worm detection system) 141
localization 312 see also SLC
in wireless sensor networks 36, 37, 38, 39–40
low-delay-jump algorithm, treebone optimization by 89, 90
MAC (medium access control) layer/protocols
14, 31, 40, 59–60, 164
malware 133–4, 312
MANET (mobile ad hoc networks) 8, 127, 192
Marcum Q function 152
Mariposa 291, 295
market exchange 277–8, 312
market exchange requirements (for utility grids) 280–2
market exchange services 278–9, 292, 302
market models 281
market-oriented scheduling
allocation decision in 288
allocation objective in 289
application type 288–9
market model in 284–7
mechanisms 279
participant focus in 288
taxonomy 283–9
market-oriented scheduling mechanisms 300–1
Markovian processes 150–2
for NCSW ARQ scheme 158–64
master–slave 39, 312
max-flow min-cut formula 201–2
upper bound 197, 206
MBS (Multi-hop Broadcast Synchronization) protocol 40
media streaming 78, 82–98, 314 see also streaming media
memory latency 220
reduction of 223, 226, 227, 229, 252–8
memory partitioning 223
mesh-based overlay designs 312
for P2P media streaming 78, 84–5
mesh networks 7, 127
mesh overlay, in mTreebone 86–7
mesh topologies 127
meta-scheduling/meta-brokering services 281, 288
metrics
CMP caching 225, 262–3
media streaming systems 92
TCP/IP 179, 185
vehicular networks 62, 65
wireless ad hoc networks 43
MiddleMan 81
middleware 36, 46–8, 312
MILAN middleware 48
military networks 7, 103, 112
MIMO (multiple-input multiple-output) systems 127, 149, 191, 312
MIMO-STP (multiple-input multiple-output space-time processing) 21
Mires middleware 48
MISO (multiple-input single-output) channel 200, 312
Moab (Silver) Grid Scheduler 297, 298–9
mobile agents 7
mobile nodes, in vehicular delay-tolerant networks 106, 108, 110
molecular caches 225–6
Moore’s law 48, 217–18
mothership (control node) 135
MRC (Maximum Ratio Combining) technique 23–4, 312
MRRM (Multi-Radio Resource Management) 119, 120, 122–4
information elements managed by 122–3
multi-access functions and procedures 122–5
announcement and discovery 123–4
connection establishment 124
handover 124–5
related approaches 125
role of 120, 122, 127–8
MTP (Multiple Time-sharing Partitioning) 252, 263–6, 267, 313
evaluation of 268–9
mTreebone
collaborative mesh–tree data delivery 91–2
mTreebone (continued)
handling node dynamics 86, 91-2
by push/pull switching 91
mesh overlay in 86-7
overview 85-7, 313
performance evaluation
by large-scale simulations 92-4
by PlanetLab-based experiments 94-8
tree-based backbone in 85-6, 87-90
multi-agent system 313
in WAdSNs 36, 48-50, 53
multicast, compared with broadcast 78-9
multi-hop relaying 14, 15, 127
multi-path propagation 149, 150
multiple-resource allocation (in utility grid) 279
multiplexing gain 21, 191, 198
multiprogrammed workloads 219, 223, 224, 225-6, 227, 252, 254
descriptions 257
in evaluation of CMP caching schemes 257, 258, 259, 262-3, 268-9
Multi-Radio Resource Management see MRRM
multithreaded workloads 219, 224, 226, 227, 256
adaptive selective replication for 224-5
descriptions 257
in evaluation of CMP caching schemes 257, 258

N-Chance Forwarding 254-5, 316 see also spilling
NAF (Non-orthogonal Amplify-and-Forward) relaying strategy 195, 313
Nakagami fading channel 152
Nash equilibrium 284
NC (Network Coding) 191, 192-5, 206, 313 see also CNC
NCC (Network Coded Cooperation) 211, 212
NCD (Network Coding and Diversity) transmission strategy 211-12
outage capacity 212-13
NCSW ARQ scheme see Node Cooperative Stop-and-Wait ...
NetShield 136, 138, 140-1
network backbone formation 41
algorithm 42
network-based IDS (NIDS) 135, 136, 139
network coding 191, 192-5, 206, 313
network errors 152, 153
network intrusions (attacks) 17-19, 67, 133-5
see also intrusion detection systems
network layer 60-7, 79, 148, 178, 179
network spread coding 194, 209-11, 313
neural networks see artificial neural networks
Nimrod/G 291, 294
NLoS (Non-Line-of-Sight) propagation 149, 150
Node Cooperative Stop-and-Wait (NCSW) retransmission scheme 148, 156-7
coopration procedure in 158
delay analysis 164-8
performance analysis 157-64
super neighbour node(s) in 158, 160, 162
non-cooperative nodes 104
NRS (negative reputation system) 10
NSC (Network Spread Coding) scheme 194, 209-11, 313
‘despread-spread-forward’ mode (NSC-DSF) 209
‘forward’ mode (NSC-F) 209, 211
OC (Optimum Combining) technique 24
OCEAN 290, 293
ODAM (Optimized Dissemination of Alarm Messages) 64-6
OFDM system 13
OFDMA (Orthogonal Frequency Division Multiple Access) 195, 313
off-chip accesses, reduction of 218, 252-7
off-chip bandwidth limitations 218-19
off-chip misses 219, 239
avoidance/reduction of 224-6, 227, 230, 232, 249, 252, 258, 262
on-chip wire delay 219
on-demand protocols 9
on-demand signaling 184
on-demand SLC 39
ONE (Opportunistic Network Environment) 108
opportunistic networks 101, 313
OSI (Open System Interconnection) layers 148
coopration at various layers
at lower layers 59-60
at upper layers 69-73
for vehicular networks 59-73
for wireless sensor networks 53
network layer coopration at 60-7
IP multicast deployment in 79
out-of-band signaling 101, 106, 314
outage capacity 197, 198, 314
outage event 198, 314
<table>
<thead>
<tr>
<th>Index</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>outage probability</td>
<td>25</td>
</tr>
<tr>
<td>overhearing</td>
<td>37</td>
</tr>
<tr>
<td>packet fragmentation</td>
<td>164</td>
</tr>
<tr>
<td>PAN</td>
<td>7</td>
</tr>
<tr>
<td>PANA (Protocol for carrying Authentication and Network Access)</td>
<td>69</td>
</tr>
<tr>
<td>Path Selection functional entity</td>
<td>122</td>
</tr>
<tr>
<td></td>
<td>124</td>
</tr>
<tr>
<td>PDF (Partial Decode-and-Forward) relaying strategy</td>
<td>200</td>
</tr>
<tr>
<td>peer-to-peer (P2P) architecture</td>
<td>81–2</td>
</tr>
<tr>
<td>peer-to-peer (P2P) media streaming</td>
<td>78, 82–98</td>
</tr>
<tr>
<td></td>
<td>314</td>
</tr>
<tr>
<td>compared with other P2P applications</td>
<td>82–3</td>
</tr>
<tr>
<td>design issues</td>
<td>83</td>
</tr>
<tr>
<td>mesh-based approaches</td>
<td>78, 84–5</td>
</tr>
<tr>
<td>overlay-construction approaches</td>
<td>83–5</td>
</tr>
<tr>
<td>tree-based approaches</td>
<td>78, 84–5</td>
</tr>
<tr>
<td>peer-to-peer SLC class</td>
<td>39</td>
</tr>
<tr>
<td>PeerMart</td>
<td>291, 296</td>
</tr>
<tr>
<td>people networks</td>
<td>103</td>
</tr>
<tr>
<td>Personalized Brokers</td>
<td>279</td>
</tr>
<tr>
<td>phishing</td>
<td>133, 134–5</td>
</tr>
<tr>
<td>avoidance of</td>
<td>138, 143</td>
</tr>
<tr>
<td>physical layer</td>
<td>148, 152, 179, 179</td>
</tr>
<tr>
<td>physical-layer network coding</td>
<td>194, 314</td>
</tr>
<tr>
<td>PlanetLab-based experiments, performance evaluation of mTreebone</td>
<td>94–8</td>
</tr>
<tr>
<td>PNC (physical-layer network coding)</td>
<td>194, 314</td>
</tr>
<tr>
<td>compared with network-coding-and-diversity</td>
<td>211–13</td>
</tr>
<tr>
<td>posted price model</td>
<td>286</td>
</tr>
<tr>
<td>power allocation, AF compared with DF</td>
<td>201–3</td>
</tr>
<tr>
<td>cooperation strategies</td>
<td>22–3</td>
</tr>
<tr>
<td>power reduction, in cooperative-diversity systems</td>
<td>28</td>
</tr>
<tr>
<td>power spectrum density, of fading process</td>
<td>150, 151</td>
</tr>
<tr>
<td>PRCSMA protocol</td>
<td>14</td>
</tr>
<tr>
<td>pricing/valuation mechanisms</td>
<td>280</td>
</tr>
<tr>
<td>primary channel</td>
<td>158, 159</td>
</tr>
<tr>
<td>private cache(s)</td>
<td></td>
</tr>
<tr>
<td>capacity sharing among</td>
<td>230</td>
</tr>
<tr>
<td>CMP caching schemes</td>
<td>224–5</td>
</tr>
<tr>
<td>compared with shared cache(s)</td>
<td>229–30, 252–3</td>
</tr>
<tr>
<td>sharing clean data</td>
<td>231, 238</td>
</tr>
<tr>
<td>private cache based organization (for CC)</td>
<td>152, 229–30, 241, 249, 251</td>
</tr>
<tr>
<td>proactivity</td>
<td>49</td>
</tr>
<tr>
<td>proportional share</td>
<td>285, 292</td>
</tr>
<tr>
<td>proportional-share resource allocation</td>
<td>262</td>
</tr>
<tr>
<td>proxy caching, for streaming media content</td>
<td>77, 80–1, 314</td>
</tr>
<tr>
<td>PRS (positive reputation system)</td>
<td>10</td>
</tr>
<tr>
<td>push/pull switching, in mTreebone data delivery</td>
<td>91</td>
</tr>
<tr>
<td>QoS (quality of service)</td>
<td>9–10, 42–3, 314</td>
</tr>
<tr>
<td>in CMP caching</td>
<td>225–6, 227, 263</td>
</tr>
<tr>
<td>for link layer retransmission protocols</td>
<td>148, 153–4</td>
</tr>
<tr>
<td>in utility grids</td>
<td>279, 301</td>
</tr>
<tr>
<td>Rayleigh fading channel</td>
<td>152, 206, 315</td>
</tr>
<tr>
<td>optimal DMT curve for</td>
<td>199</td>
</tr>
<tr>
<td>relay channels</td>
<td>8, 158, 159</td>
</tr>
<tr>
<td>relaying</td>
<td>315</td>
</tr>
<tr>
<td>relaying protocols, in cooperative-diversity systems</td>
<td>31</td>
</tr>
<tr>
<td>relaying stations</td>
<td>14</td>
</tr>
<tr>
<td>relaying techniques, in cooperative-diversity systems</td>
<td>22–3</td>
</tr>
<tr>
<td>remote-area networks</td>
<td>103, 112</td>
</tr>
<tr>
<td>replicas (cache copies)</td>
<td>219, 223, 233, 246, 253, 254, 255</td>
</tr>
<tr>
<td>replication-aware cache replacement</td>
<td>253–4</td>
</tr>
<tr>
<td>reputation and monitoring system (for utility grid)</td>
<td>281</td>
</tr>
<tr>
<td>reputation systems</td>
<td>10</td>
</tr>
<tr>
<td>‘resource hog’</td>
<td>315</td>
</tr>
<tr>
<td>as DTN network node</td>
<td>105</td>
</tr>
<tr>
<td>resource management</td>
<td>31–2, 315</td>
</tr>
<tr>
<td>resource provider side requirements (for utility grids)</td>
<td>280</td>
</tr>
<tr>
<td>resource-usage estimation (in utility grid)</td>
<td>280</td>
</tr>
<tr>
<td>resource utilization</td>
<td>23</td>
</tr>
<tr>
<td>resources over-utilization</td>
<td>28–9</td>
</tr>
<tr>
<td>resources reservation</td>
<td>106</td>
</tr>
<tr>
<td>retransmission protocol</td>
<td>153</td>
</tr>
<tr>
<td>RFID</td>
<td>7</td>
</tr>
<tr>
<td>Rician fading channel</td>
<td>152</td>
</tr>
<tr>
<td>road traffic density estimation</td>
<td>71–3</td>
</tr>
<tr>
<td>routing</td>
<td></td>
</tr>
<tr>
<td>address-centric approach</td>
<td>44</td>
</tr>
<tr>
<td>data-centric approach</td>
<td>44</td>
</tr>
<tr>
<td>in delay-tolerant networks</td>
<td>103</td>
</tr>
<tr>
<td>position-based</td>
<td>60–1</td>
</tr>
<tr>
<td>in vehicular networks</td>
<td>60–3</td>
</tr>
<tr>
<td>in wireless sensor networks</td>
<td>41–3</td>
</tr>
<tr>
<td>RSS (Radio/Received Signal Strength) method</td>
<td>38, 39, 314</td>
</tr>
</tbody>
</table>
Index

S-MAC 38
satellite nodes (in DOMINO system) 139, 140
SC (Selection Combining) technique 23–4, 315
scalability
  of cognitive network 181
  in P2P media streaming systems 83
  of WAdSNs 36, 53
search-and-detection networks 123
security issues
  in vehicular networks 59, 67–9
  in wireless sensor networks 15–19
security system, in utility grid 282
security threats
  in cooperative-diversity systems 32
  in wireless sensor networks 17–19
selective filtering 18
Selective Repeat retransmission protocol 154–5
self-organizing cooperative vehicular networks 60, 66–7
self-organizing map 41, 45, 315
sensor networks 7, 12–13, 35
Service Level Agreement 278, 315
SETI@Home project 10
Shannon capacity 197, 315
  of cooperative-diversity systems 28
shared cache(s)
  CMP caching schemes for 223–4
  compared with private cache(s) 252–3
shared resource management 222–3
SHARP 290, 292–3
Shirako 290, 293
signal combining and detection, in
  cooperative-diversity systems 30–1
signaling information, exchange of 106–7
signaling methods
  broadcast signaling 184
  in-band signaling 183
  on-demand signaling 184
  out-of-band signaling 101, 106, 314
signaling plane 181
signature-based IDSs 135
SINA middleware 47
single-point-of-failure 136, 315
single-sided auctions 287, 288
singlet (cache block) 253–5, 258, 315
SIR (Sensor Intelligence Routing) algorithm 42
SLA (Service Level Agreement) 278, 280, 315
SLC (synchronization/localization/calibration) 36–41, 53
  continuous vs on-demand 39
  external vs internal 39
  master–slave vs peer-to-peer 39
SmartPark system 71, 72, 73
SmartScreen Filter 138, 143–4
SNR (signal-to-noise ratio) 315
  in cooperative-diversity systems 23–6, 28–9
  in multi-hop relaying 21
social engineering 134
social networks 103, 112
SOM (self-organizing map) 41, 45, 315
SORMA 291, 294–5
space–time coding (STC) 24–5, 149
space–time processing 21, 315
spam 133
spam filters 138, 143
Spawn 290, 292
spiking neural networks 51, 52
spilling 232, 238–9, 316
  pull-based 238–9
  push-based 239
spoofing 18
Spray-and-Wait routing protocol 104, 109
  performance assessment of 105, 110–12
spyware 134, 316
SSP (Single Spatial Partition) based cache partitioning schemes 265
  compared with MTP based schemes 265–6
startup latency 92
  mTreebone compared with other systems 92–3, 96
state transition models 160, 161
stationary relay nodes 14, 106, 108, 109
STC (space-time coding) 24–5, 149
store-carry-and forward 101, 102, 106, 316
streaming media content, cooperative overlay networking for 77–98
super neighbour node 158, 160, 162
superposition transmission 25, 29, 316
SW (Stop-and-Wait) retransmission protocol 153
Sybil attack 18–19
synchronization 31, 36
synergistic caching 224
table-driven protocols 9
TBP (Ticket Based Probing) 9
TCP/IP (Transmission Control Protocol/Internet Protocol) 101
  protocol stack 148, 178–9, 179
TDMA (Time Division Multiple Access) 29–30, 37, 195, 316
TDOA (time difference of arrival) method 38, 39, 316
technical subterfuge 134
terrestrial contributors (in DOMINO system) 139, 140
TFT (tit-for-tat) mechanism 104–5
thrashing 219
thrashing avoidance 222, 262, 263–4
throttling 229, 234, 241, 255–7, 268
throughput
of cooperative-diversity system 28, 29
of NCSW scheme 164, 169–71, 172
of retransmission protocol 153
of SW scheme 154, 156
time synchronization 36, 37–8, 40, 316
time-triggered SLC 39
TPSN (Time-synchronization Protocol for Sensor Networks) 40
traffic mining 18
transient networks 103
Transmission Control Protocol (TCP) 178
see also TCP/IP
optimization using cooperative framework 184–9
inter-layer cognitive optimization 186–7
inter-node cognitive optimization 187–9
transmission delay 92
mTreebone compared with other multicast systems 93, 96
transport layer 148, 152, 178, 179
tree-based backbone see also treebone in mTreebone 85–6
tree-based overlay designs 316
for P2P media streaming 78, 84–5
treebone 85–6
bootstrapping and evolution 88, 89
construction of 87–9
optimal stable node identification 87–8
optimization of 89–90
by high-degree-preemption 89–90
by low-delay-jump 89, 90
TRG (Triggering) functional entity 121, 124
Trojan 134, 316
trust management systems 138
Two-Hop routing algorithm 104
performance assessment of 105
Tycoon 285, 290, 292, 301
unavailability of cooperating nodes 32
underwater networks 103, 112
unstructured networks 191–2, 194, 207
user-centric brokers 279
user-level grid middleware 282, 283, 301
utility computing 277, 316
utility grids
infrastructural components 282–3
overview 277–9
requirements 279
consumer side requirements 279–80
market exchange requirements 280–2
resource provider side requirements 280
VANET (Vehicular Ad hoc Network) 57, 62
VDTNs see vehicular delay-tolerant networks vehicular delay-tolerant networks 101, 106–12, 317
cooperation in 106–8
performance assessment of node cooperation 108–12
for Epidemic routing protocol 109–10
network setup 108–9
for Spray-and-Wait routing protocol 110–12
vehicular networks 57–73, 103
applications 57, 58, 73
characteristics and requirements 58–9
cooperation at lower OSI layers 59–60
cooperation at network layer 60–7
cooperation at upper OSI layers 69–73
cooperative dissemination in within city environment 63–5
within highways 65–6
cooperative routing in 60–3
security and authentication in 67–9
self-organizing 66–7
V2I (Vehicle-to-Infrastructure) architecture 58
information exchange between vehicles and gateways 62
Vickrey Auction 287, 296
victim caching 222, 223
video streaming 178 see also media streaming virtual array gain 26
virtual backbone structure 67
V2V (Vehicle-to-Vehicle) ad hoc network 58, 65
WAdSNs (Wireless Ad Hoc Sensor Networks)
artificial neural networks in 50–2
cooperation in 35–53
data aggregation and fusion 43–5
WAdSNs (Wireless Ad Hoc Sensor Networks)  
(continued)  
middleware 46–8  
multi-agent systems in 48–50  
routing in 41–3  
SLC techniques 36–41  
Walsh spreading sequences 198, 317  
wildlife tracking networks 103, 112  
WiMax 7, 118  
wireless ad hoc network(s) 154, 317 see also WAdSNs  
WLANs (Wireless Local Area Networks) 7, 118, 154  
authentication and access control in 68  
Worminator 137, 138, 142  
worm(s) 134, 317  
detection of 138, 140–2  
WRANs (Wireless Regional Area Networks) 126  
WSNs (Wireless Sensor Networks) 12, 192  
characteristics 13  
environment limitations 16  
hardware limitations 16  
network limitations 16  
security issues 15–19  
WZC (Wyner–Ziv Coding) 197, 317  
zombies 18  
ZRP (Zone Routing Protocol) 9