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# Wireless Networked Music Performance

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# Preface

Networked music performance is often intended as a practice of remote performance, with musicians displaced far away at distant locations. Networking, however, does not only have the potential of getting remote performers closer, but also allows local performers to get farther, explore larger spaces, move to outdoor venues, yet feel as close as they need to perform well. Furthermore in computer music and electroacoustic practice, live electronics can be digitally interconnected in unprecedented ways, thanks to networking. The laptop performance paradigm already exploits networking for control data exchange. However, with the steady switch from analog links to digital connections, possible due to improvements and adoption of digital audio networking technologies, creative possibilities for performers are open to explore and the exploitation of wireless links is the necessary step to really make this possibilities of convenient adoption.

A comprehensive state of the art in networked music performance (NMP) and a historical survey of computer music networking is reported to later introduce current technical trends in NMP and technical issues are yet to address. Wireless communication protocols are listed and compared to the requirements of NMP. Two chapters are, then, dedicated to works related to wireless NMP, especially those from the authors, who have devoted their last 3 years on wireless music networking research. The current outcomes of the WeMUST project are reported with practical results and application reports.

The last chapter closes the book, with future issue to investigate. Lastly, an appendix providing a short addendum on wired Audio over IP standards is given.

Ancona  
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# Abbreviations

ACL	Asynchronous Connection-Less
A/D	Analog-to-Digital conversion (also, ADC)
AES	Audio Engineering Society
ALSA	Advanced Linux Sound Architecture
API	Application Programming Interface
BSS	Basic Service Set
CSMA/CA	Carrier Sense Multiple Access with Collision Avoidance
CSMA/CD	Carrier Sense Multiple Access with Collision Detection
DAW	Digital Audio Workstation
DCF	Distributed Coordination Function
DFA	Delay Feedback Approach
DHCP	Dynamic Host Configuration Protocol
DLL	Delay-Locked Loop
DNS	Domain Name System
DSP	Digital Signal Processor or Digital Signal Processing depending on the context
D/A	Digital-to-Analog conversion (also, DAC)
DSL	Digital Subscriber Line
EPT	Ensemble Performance Threshold
FFT	Fast Fourier Transform
FTA	Fake Time Approach
GP	General Purpose
GPS	Global Positioning System
GUI	Graphic User Interface
IC	Integrated Circuit
ICN	Information-Centric Network
IP	Internet Protocol or Intellectual Property depending on the context
ISM	Industrial Scientific Medical
JACK	Jack Connection Kit
LAA	Latency-Accepting Approach
LAN	Local Area Network

LBA	Laid Back Approach
LTE	Long-Term Evolution
LUT	Look-Up Table
MA	Musical Application
MAC	Multiply and ACcumulate
MIDI	Musical Instruments Digital Interface
MIMO	Multiple Input Multiple Output
MPC	Mixing Personal Computer
MSA	Master–Slave Approach
NFC	Near Field Communication
OS	Operating System
OSC	Open Sound Control
OSS	Open Sound System
PCF	Point Coordination Function
PDF	Probability Density Function
PDV	Packet Delay Variation
PLL	Phase-Locked Loop
PLR	Period Loss Rate
QoS	Quality of Service
RIA	Realistic Interaction Approach
RISC	Reduced Instructions Set Computing
RTT	Round-Trip Time
SABy	Simple Autonomous Buddying
SCO	Synchronous Connection-Oriented
SFG	Signal Flow Graph
SoC	System on a Chip
SME	Small-to-Medium Enterprise
SNR	Signal-to-Noise Ratio
SP	Signal Processing
STP	Standard Temperature and Pressure
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UPnP	Universal Plug and Play
WAN	Wide Area Network
WASN	Wireless Acoustic Sensor Network
WLAN	Wireless Local Area Network
WPS	Wi-Fi Protected Setup