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LCOS LANCOM Operating System

The LANCOM operating system LCOS reflects over 10 years of innovation and excellence in network technology and data communication.

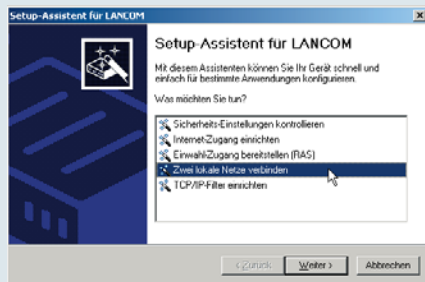
LCOS 7.6
(LANCOM OPERATING SYSTEM)

- Higher levels of security – the proprietary operating system protects against unauthorized access and attacks
- Simple configuration and standardized operation of all LANCOM products
- Comprehensive feature set for all LANCOM products
- WEBconfig – configuration via browser
- Firmsafe – backup for remote software updates
- Immediate response to inquiries and customer requests
- Minimal training requirements due to standardized operation of all products
- Parallel configuration and monitoring via graphical user interface
- LANCOM firewall with Intrusion Detection and Denial of Service protection
- Simple installation with plug & play and Setup Wizards

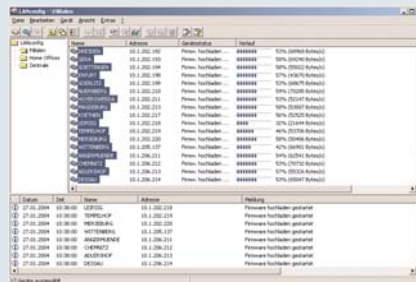
LANCOM
Systems

LCMS – LANCOM Management System

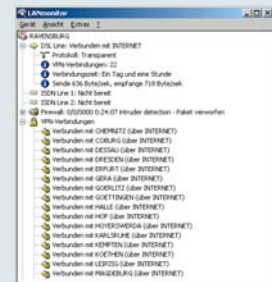
- Comprehensive, user-friendly tools for the management of all LANCOM products
- Simple configuration and monitoring of all products
- High usability by intuitive design
- Simultaneous management of multiple devices
- Security and statistics information on demand
- Integrated diagnostic tools (graphical user interface with Wizards for TRACE commands)



LANconfig – Setup Wizard



LANconfig



LANmonitor/WLANmonitor

LCOS updates are regularly available free of charge for unparalleled protection of your investment.

Firewall	Stateful inspection, IP packet filter with port ranges, object-oriented rule definition. Masking (NAT/PAT) of TCP, UDP, ICMP, FTP, PPTP, H.323, Net-Meeting, IRC and IPsec; DNS forwarding. Extended port forwarding and N:N mapping. Support for up to 64 contexts with individual IP networks, VLANs and interfaces, bandwidth management, QoS and VLAN prioritization for VoIP and VoWLAN	
Operating modes	LAN protocols	IP: ARP, Proxy ARP, IP, ICMP, UDP, TCP, TFTP, RIP-1, RIP-2, DHCP, DNS, SNMP, HTTP, HTTPS, SSH, Telnet and SIP, BOOTP, NTP/SNTP, NetBIOS, RADIUS, LANCAPI IPX: RIP, SAP, IPX and SPX watchdogs, NetBIOS watchdogs
	WAN protocols (Ethernet)	PPPoE, PPTP (PAC or PNS) and Plain Ethernet (with and without DHCP), RIP-1, RIP-2
	Multiprotocol router	IP router, IPX router, NAT/Reverse NAT (IP- masquerading), DHCP server incl. autodetection, DHCP client, DHCP relay server, DNS server, PPPoE client / Multi-PPPoE, ML-PPP, PPTP (PAC and PNS), NetBIOS proxy, DynDNS client, GnuDIP client, N:N address mapping and port mapping.
	ISDN gateway	ISDN gateway ISDN S ₀ bus, point-to-point and point-to-multipoint configuration, I.430, (Autosensing); D channel: 1TR6, DSS1 (Euro-ISDN); B channel: PPP (asynchronous/synchronous), X.75, HDLC, MLPPP for channel bundling, CAPI 2.0 via LANcapi, Stac data compression
IPSec	IPSec clients	Encryption algorithms DES (56 bit), 3-DES (168 bit), AES, Blowfish (128-448 bit), CAST (128 bit), MD-5 or SHA-1 Hashes IKE with X.509 digital certificates or preshared keys, SCEP, IKE Config Mode, NAT-T, IPCOMP, up to 16 redundant VPN gateways for high availability and load balancing, Dynamic VPN LANCOM Advanced VPN client for Windows 2000, XP and Vista, incl. firewall, automatic connection-establishment tools, profiles for UMTS/GRPS/WLAN, analog, ISDN and DSL/PPPoE, X.auth/Config Mode, IPCOMP
Dynamic VPN	Dial up to dynamic IP addresses: Transmission of dyn. IP address via ISDN B or D channel, IKE main mode. Dial up dynamic to static IP addresses: Transmission of dyn. IP address via ICMP- or UDP packet, IKE main mode. Trigger by ISDN data call, N:N address mapping for connecting locations with identical subnets	
VoIP Call Manager	SIP-PBX	PBX functions for exchange between local analog, ISDN and SIP subscribers (depending on device's interfaces) as well as with upstream PBXs or external analog, ISDN and SIP subscribers
	Call router	Central routing of incoming/outgoing Calls, number mapping, digit replacement, number concatenation, configuration of several alternative target lines (line backup)
	SIP proxy and registrar	Management of local SIP users, inclusion of public SIP provider accounts as lines for common use, connection to upstream SIP PBXs including line backup.
	SIP gateway	Transparent conversion of analog (DTMF dialing) or ISDN (Euro ISDN/DSS1) calls to SIP and vice versa (depending on device's interfaces)
	VoIP Media Proxy	Termination and interconnection of multiple media streams. Control of media sessions resulting from SIP connections. IP address and port translation for media stream packets between different networks.
	Connection	of parties at media stream level where a call transfer in SIP (REFER) is not possible
	Auto QoS	Automatic dynamic bandwidth reservation per SIP connection. Voice packet prioritization (CoS), DiffServ marking, traffic shaping (incoming/outgoing) and packet-size management of non-prioritized connections compared to VoIP
	Other functions	SIP over IPSec, SIP trunk, SIP link, SIP remote gateway, Media Proxy, ISDN with MSN/DDI and point-to-multipoint/point-to-point ISDN even with 1TR6 (only at external landline connections), support for G.722 in ISDN and SIP, SIP DTMF support according to RFC 2976 (SIP Info), RFC 2833 (RTP Payload Type/outband), echo cancellation (G.168), automatic adaptive de-jitter buffer, inband tone signaling (EU standard and country specific), fax transmission with G.711 or T.38 in LAN and WAN
Wireless LAN	WLAN access point	Up to 255 Clients
	WLAN client	Client Mode for connecting printers or PCs by Ethernet
	WLAN bridge	Point to multipoint connection from up to 7 Ethernet LANs (mixed operation optional), Wireless Distribution System
	Frequency band	2400 – 2483.5 MHz (ISM) or 5150 – 5850 MHz
	Super A/G	108 Mbps Turbo Mode (channel bundling), bursting and hardware data compression (IEEE 802.11a/g)
	WLAN standards	IEEE 802.11a/b/g/h/i with 54 Mbps or 802.11n with 300 Mbps
	Transmission range*	Up to 150 m (up to 30 m in buildings)
	Transmission power	Up to 17 dBm at 2.4 GHz Band, up to 18 dBm at 5 GHz Band with automatic Power Control (TPC) and manually adjustable/semi-automatic power output (5 GHz: max. 30 dBm EIRP, 20dBm in 2.4 GHz)
	Radio channels	Up to 19 non-overlapping channels (5 GHz Band) with automatic dynamic channel selection (DFS), or up to 11 channels, max. 3 non-overlapping (2.4 GHz Band)
	Roaming	Seamless handover, IAPP-Support, IEEE 802.11d support, Spanning Tree
	VLAN	802.1p/q VLANs with 4094 IDs and 8 priorities, dynamic VLAN assignment by MAC/SSID/BSSID
	Multi SSID	Up to 8 independent WLAN networks per radio module
	Security	802.11i with hardware AES encryption, WPA/TKIP, WEP, LEPS, 802.1x, access control lists, protocol filters, IP
	redirect	
	QoS	WME (part of 802.11e)
	Rogue AP detection	Background scanning and client detection to identify rogue APs and clients on all WLAN channels
	Fast roaming	PMK caching, pre-authentication for 802.1x and fast client-mode roaming via background scanning
IP Quality of Service	Dynamic bandwidth management with IP traffic shaping, dynamic bandwidth reservation, TOS or DiffServ priority queuing, globally or per session, individually per send and receive direction, automatic packet size adjustment with PMTU reduction or fragmentation, layer 2/3 tagging (copying of 802.1p to DiffServ and back to 802.1p for end-to-end QoS)	
Diagnosis	Diagnostics Extensive LOG and TRACE possibilities, globally or per remote site. Integrated PING and TRACEROUTE to check connections, LANmonitor status display and protocol, internal logging buffer for SYSLOG and firewall events, monitor mode for Ethernet ports, partial RTTMON MIB for QoS monitoring. Graphical user interface for TRACE in LANmonitor	

*) The effective distance and transmission rate that can be achieved depend on the given building conditions.

Management	LANconfig including Setup Wizards for Internet access, security, firewall, dynamic DNS, remote access and LAN-LAN coupling; 1-Click VPN via drag&drop; group configurations; WLANmonitor, LANmonitor status display, RADIUS user administration for dial-in access and WLAN access control, EAP server, remote maintenance via ISDN, Telnet/SSL, SSH, WEBconfig (http/https) and HTTPS/TFTP configuration/scripting and firmware upload, SNMP management via SNMPv2 (MIB II, 802.11, 802.1d, 802.3, private MIB), Individual configuration of access rights for all local and remote access methods, individual access rights for up to 16 administrators, simultaneous remote configuration and version management of multiple devices, alerts from SNMP traps, SYSLOG or e-mail, scheduled control of commands with CRON service, TFTP client and server with variable file names (name, MAC/IP address, serial number). Scripting function for batch-programming of all command-line parameters for transferring (partial) configurations, irrespective of software versions and device types, incl. test mode for parameter changes
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Functions as of LCOS 3.32

LCOS3.32 (LANCOM OPERATING SYSTEM)

VPN upgrade	Upgraded VPN gateway functions: 5 VPN channels integrated (instead of 2 channels) for all products of the 1600 and 1800 series. Former VPN-2 Option upgraded to 5 channels
QoS	Extended Quality-of-Service features – optimum Voice-over-IP for voice quality via VPN connections. Also available to the already integrated (send-side) bandwidth management: <ul style="list-style-type: none"> • Extended IP QoS • Dynamic download „slow down“ • Automatic packages adaptation and PMTU setting or fragmentation (jitter reduction) (in particular for low ADSL upstream bandwidths) • DiffServ-Trigger in the IP-Router and the firewall
Virtual LANs (VLAN)	VLAN enables separate networks use common LAN or WLAN infrastructures <ul style="list-style-type: none"> • VLAN-ID connecting segments • VLAN-Prio enabled Quality-of-Service VLAN-capable switches convert normal Ethernet to the VLAN segment and back
N:N IP mapping	IP address mapping from one network to another address range <ul style="list-style-type: none"> • VPN network coupling also with identical IP networks • N:N address mapping on well-defined IP addresses („loopback-addresses“) • Central SNMP management for several networks with identical IP addresses
LANconfig/LANmonitor	Multitasking – project management and monitoring (e.g. centralized firmware update) Hardware integration and configuration, registration of change history Real-time remote monitoring per SNMP trap Monitoring of all relevant technical events (VPN, WLAN, connections, security), recording of all changes.

Functions as of LCOS 3.42

LCOS3.42 (LANCOM OPERATING SYSTEM)

Multi SSID	Each WLAN radio module now supports up to 8 different radio cells (SSIDs). All settings for security and access can be independently configured for each SSID. This, for example, enables a private WLAN intranet to be operated parallel to a separate, public WLAN hotspot.
Super A/G	Increases the transfer rates in 2.4 and 5 GHz WLANs. The 108-Mbit Turbo Mode bundles two vacant WLAN channels and so doubles the effective bandwidth. Bursting combines multiple packets to save overhead and uses the available bandwidth more effectively. Hardware data compression can be used for point-to-point connections between two access points.
VPN trigger call	VPN connections to a set remote station can now be triggered by an ISDN data call.
ISDN backup for Dynamic VPN	ISDN backup functions formerly suffered from limitations in combination with dynamic VPN: These limitations now no longer apply. It is now possible to use dynamic VPN to secure an ISDN direct-dial connection with dynamic IP addresses at both ends.
IP redirect	For each SSID, dedicated WLAN-to-wired LAN transfer points can be defined so that data packets received from the WLAN are forcibly redirected to just one set IP address

Functions as of LCOS 3.50

LCOS3.50 (LANCOM OPERATING SYSTEM)

	LCOS 3.50 provides a WLAN security update for all LANCOM WLAN routers, access points and AirLancer clients adapters with 54 Mbps radio modules. Supported encryption methods are 802.11i/AES and WPA/TKIP. 802.11i provides a security level according to FIPS 140-2. The AES encryption utilizes the integrated hardware encryption engines of the LANCOM 54 Mbps radio modules, which ensure a encryption at full speed. Additionally, the installation of WPA passphrases is much more comfortable than WEP.
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Functions as of LCOS 4.00



LEPS—extended WLAN security	The innovative LANCOM Enhanced Passphrase Security method (LEPS) is a new technology offering each and every WLAN user a separate WPA passphrase without the need of complex 802.1x infrastructure. Until now, it was necessary to issue all WLAN clients with the same password (i.e. if an employee departs from the company then all WLAN clients have to be reconfigured) or to operate an 802.1x infrastructure featuring an EAP-capable (Extended Authentication Protocol) RADIUS server. LEPS is simple and yet ingenious. A LANCOM access point can manage an individual passphrase for each MAC address. Access to the WLAN is only permitted with the combination of the MAC address and its associated passphrase. LEPS functions with all WPA / 802.11i-capable clients. The access control list with the approved MAC addresses and individual passphrases can be stored in the LANCOM access point or in any standard RADIUS server.
WLAN hardware data compression	Effective immediately, all 54-Mbit LANCOM access points and 54-Mbit AirLancer client adapters can make use of their integrated hardware data compression. This increases the effective data throughput rate in combination with bursting and turbo mode from 40 Mbps (standard: 20 to 30 Mbps) to a value of 60 Mbps – even when using AES encryption at the same time.
802.11i for WLAN P2P connections	Now point-to-point WLAN connections can take advantage of the AES hardware encryption that is featured in the LANCOM 54 Mbit radio module. The combination of WLAN turbo mode and transmitting powers of up to 1000mW at 5 GHz (802.11a) allows the operation of wireless connections that are secure from interception (thanks to 802.11i) at up to 108 Mbps and over distances in excess of one kilometer.
Default encryption for WLAN	Device-specific WLAN encryption is activated by default in the settings from the factory and after resetting. This ensures that a minimum of security is provided even if the user forgets to run the installation and security wizards or following a reset. The 13-character default WEP128 key is made up of the device's 12-character MAC address preceded by an 'L'.
Redundant VPN gateways	Activation of multiple VPN end points (mostly identically configured central VPN gateways operated in parallel) for load balancing and high availability within large VPN installations. Should line polling (dead-peer detection, ICMP line polling) indicates a failure, then a variety of strategies (e.g. "random") can be used to enable communication to a different VPN end point. At the central headquarters, the new outbound router and the local default gateway are propagated by dynamic routing (RIP V2).
IKE config mode	Automatic allocation of IP addresses to VPN remote sites, for example to the LANCOM Advanced VPN Client.
Access for multiple administrators	Several administrators can access the device with individual passwords and access rights. The device password formerly in use is now exclusively for the supervisor. Extended login functions are now available under WEBconfig, telnet, TFTP and SNMP. Up to 16 roles can be defined with differing rights for configuring the device and running functions.
SSH configuration access	Support of the SSH protocol as an additional method for accessing the command-line interface, for example with the freely available "PuTTY" tool (telnet via SSH client, for Windows and Unix).
Port mapping	Enables freely definable port remapping, for example to divert local servers to non-standard ports.
Multi-PPPoE	Now one DSL access can be used to operate multiple Internet accesses to different Internet service providers. Multiple PPPoE sessions can be used, for example, as an ISP backup or for separate invoicing of business and private Internet access.
RIP via WAN	RIP via WAN The propagation of static or dynamic routes via RIP V2 can now take place over the WAN, for example for the updating of routes within closed networks (e.g. MPLS-based VPNs).
Manual MTU definition	In addition to the automatic adaptation of the maximum packet size over a certain transmission route, these values can now also be statically overwritten. This is necessary, for example, for tunneled connections operated by Internet service providers who resell DSL connections. In these cases, the automatic MTU negotiation with the DSL access provider can cause an oversized MTU value (e.g. 1492) as the tunneling to the ISP can lead to additional overhead. In such cases, the MTU can be reduced manually (e.g. to 1400 bytes).
"Loopback" addresses	A device can be assigned up to 16 additional IP addresses so that the device can be uniquely identified (e.g. for the maintenance of devices in multiple networks using the same IP address range).
Internal logging	In addition to the existing firewall event log, the activated SYSLOG module stores the last 100 SYSLOG messages directly in the device; this is useful, for example, as an "error memory" for the remote diagnosis of interrupted connections.
Software version management with LANconfig	Simple version management with this firmware archive plus update function. Either for the convenient, centralized update of installations with different types of devices, or even for a specific rollback.
New LANmonitor	Now with button bar for direct access to functions and new windows management for supervising larger installations.
Analog and GPRS modem	Connecting an external analog or GSM/GPRS modem to the serial interface ("Config/COM") provides an additional fully-functional WAN connection. All functions are available including hold time, automatic return to the standard connection when using Backup, or dial-in connections (e.g. for remote maintenance). Even Dynamic VPN applications that rely on the exchange of IP addresses per telephone connection are possible. Individual modem parameters can be configured with AT commands. Line status and connect rates are displayed clearly in LANmonitor. Owing to the different circuitry, the LANCOM Modem Adapter Kit is necessary for the operation of external modems.
Additional polling addresses	End-to-end connection monitoring by ICMP polling ("ping") now has up to four polling addresses. The backup event is only triggered when contact is lost to all polling addresses.
WLAN P2P connections with 802.11i	The integrated AES encryption in WLAN radio modules can now be used for WLAN point-to-point connections too.
N:N mapping for all devices	Formerly implemented for VPN devices only, N:N IP-address mapping is now available for devices without VPN—for example, for integrating locations with MPLS networks.
CPU-load and memory display	LANmonitor displays detailed information such as the CPU type and speed, total memory and current free memory in the system information under 'Device'.
Extended ping command	The new option '-a' enables the definition of a dedicated sender address (e.g. intranet, DMZ or any). As early as when commissioning the device, the router can be tested in advance for correct functioning in relation to other routed networks.
Extended comment fields	Four freely definable comment fields are now available to handle the general device information such as device name, location and administrator.

Functions as of LCOS 4.12

LCOS 4.12 (LANCOM OPERATING SYSTEM)

UMTS support

A UMTS data card can be operated in the external card bus of the LANCOM 3550 / 3050 Wireless models in combination with the new LANCOM UMTS/VPN Option. Currently supported are the UMTS/GPRS data cards U-530 and U-630 from Novatel Wireless. UMTS-based broadband access can be realized, for example for a 'mobile conference room' allowing WLAN or LAN access to the company's network from any location over UMTS and VPN. What's more, UMTS is an ideal backup as it offers more speed, better reliability, and lower long-term running costs than the typical DSL backups via ISDN. The UMTS/WLAN router activates 5 VPN tunnels simultaneously for the UMTS/VPN.

Functions as of LCOS 5.00

LCOS 5.00 (LANCOM OPERATING SYSTEM)

X.509 digital certificates

Improved security for IPSec VPNs: Digital certificates can now be used for LAN-LAN coupling and VPN client dial-in connections. Supported are self-signed PKCS#12 soft certificates created by the Microsoft Certificate Services (Server or Enterprise Server) or OpenSSL. Digital certificates have numerous advantages over the pre-shared key method:

- VPN clients can be operated in the more secure IKE main mode
- Reciprocal certificate verification
- Additional information can be integrated into certificates (e.g. company name, division, etc.)
- Time-limited validity
- No more 'simple' passwords – lower susceptibility to dictionary attacks
- Support of Smartcards and tokens – prevents passwords being read from notebooks/PCs
- Integration in Active Directory environments – central rights management

The PKCS#12 files with root certificate, device certificate and private key can be uploaded to devices with WEBconfig via https. The LANCOM Advanced VPN Client features an import function.

AES-256 and IPCOMP

AES encryption now operates with bit depths of 128, 192 and 256 bits. Hardware AES acceleration can still be used with appropriate devices. The Blowfish encryption depth now operates with up to 448 bits. IPCOMP offers data compression in the VPN tunnel. Data throughput in the VPN tunnel can be accelerated with the compression algorithms LZS and Deflate.

Load balancing

Depending on the model, up to 4 external DSL modems or termination routers can be connected directly to the switch ports to provide additional WAN ports. Automatic load balancing means that extra broadband connections can simply be plugged in for an overall increase in performance. There is also complete redundancy in case of the failure of one or more lines.

ML-PPP

Up to 4 PPPoE connections (e.g. lines with DSL modems) can be combined with channel bundling. This increases not only the transfer capacity but the effective maximum speed as well. For example, 4 PPPoE-based SHDSL connections with 2 Mbps each can be unified to an 8-Mbps connection.

Configurable switch ports

Many models support the flexible programming of switch port functions. The operating modes are 'off', LAN port, separate DMZ port, WAN port (for additional WAN interfaces for load balancing), and monitor port. A monitor port can be used for diagnostics by outputting all of the traffic at the other Ethernet LAN and WAN ports.

Policy-based routing / tags

The firewall can attach a tag to a data packet after initiation by any trigger or rule. These tags are processed in the extended routing table. The result is fully flexible routing that was formerly based only on destination addresses. In combination with load balancing, certain services such as VoIP, VPN or e-mail can be directed exclusively through certain lines. Depending on the data type, one of a multitude of default routers can be addressed as determined by the sender address, DiffServ marking, or depending on the protocol used.

WLAN group configuration

LANconfig makes administration easier with the central configuration of multiple grouped WLAN access points. A group configuration can be assigned to a group folder to centrally define uniform WLAN parameters (e.g. encryption, access control lists) for all of the devices in that group. Changes to the group configuration are carried out for all devices in the group. Discrepancies from the group configuration are detected and an update suggested automatically. Devices can be integrated into a group simply by drag and drop, and group parameters can be derived from a single device.

WLANmonitor

The new WLANmonitor makes child's play of the centralized surveillance of WLAN installations. For each WLAN device, the registered clients are displayed along with the frequency channel in use, the encryption settings, and the current signal quality, and data rate. Simply clicking on a client marks the access point that it is logged on to. Non-authenticated clients are shown in red along with the reason for the error.

Scripting

The new scripting interface allows command-line parameters to be transferred via script files.

Scripting offers the following advantages:

- For the first time, a portions of a configuration can be transferred to the device(s), such as firewall settings, access control lists, VPN or DHCP/DNS settings
- Scripts can be transferred between different software versions and different types of device
- Batch programming of all LANCOM functions realizes new applications, such as a "test mode" for changing parameters with the help of the "Flash off" and "Sleep" commands
- Scripts are easy to read, clear and compact as only values that differ from the factory settings are listed
- Scripts contain LANCOM commands in plain text and can be edited with any text program. Even comments are generated automatically.

Scripts are uploaded with Loadscript at the command line or via a LANconfig context menu item. The new Readscript command allows the export of the commands executed for a configuration to a text file.

Delete Wizard	LANconfig now features a Wizard for the complete removal of unwanted connections and remote sites along with all related configuration settings.
ISDN site verification	Protection from break-ins with stolen devices—routers with an ISDN interface can call themselves back to establish if the router is still situated at its intended location. If this check fails, then the device locks up and no data transfers will be possible, for example over a VPN connection to the company.
Wake-up on LAN	Supports device remote activation /remote PC wake-up upon receipt of activation packets.
Transparent WLAN client mode	A MAC-transparent mode is available when operating a LANCOM access point as a WLAN client. This allows MAC address-based authentication in client mode as well.
DFS blacklists / whitelists	The DFS channel switching times in 5-GHz WLANs can be optimized with lists of suitable channels.
TFTP file names with variables	The distribution of software, such as of individual device configurations and scripts, is aided by the inclusion of variables—i.e. the respective MAC or IP address, device serial number or identifier—in the file names of the integrated TFTP servers and clients.

Functions as of LCOS 5.20

LCOS 5.20 (LANCOM OPERATING SYSTEM)

ADSL2+	ADSL2+ A downstream speed of up to 24 Mbps can be achieved with the ADSL2+ standard, compliant with ITU G.992.5. A software update to LCOS 5.20 featuring new ADSL line code makes the following products ADSL2+ compliant; LANCOM 821+, LANCOM 1721 VPN and LANCOM 1821 Wireless ADSL (1821 from hardware release E).
VRRP	VRRP (Virtual Router Redundancy Protocol) provides a manufacturer-independent redundancy protocol according to RFC 3768. Multiple VRRP-capable devices can be combined to form a standby group, generally with one device acting as master and maintaining the connections. With this VRRP master set as the default gateway and reachable via virtualized MAC and IP addresses, redundant routers provide network backup without the need to make manual changes in the LAN. As standard the LANCOM VRRP function is triggered by device failure, although this can also be linked with the availability of individual remote stations, or with the function of connections or interfaces. Another option is the parallel load-balancing operation of multiple devices, which then act to back each other up. The short propagation time (standard 1s) and the virtualization of the default gateway provides an extremely fast and transparent failover.
NAT-T	NAT-Traversal allows IPsec VPN applications to operate over connections using routers that do not support VPN pass-through. The consistency of the TCP/IP header in ESP packets is automatically checked during the IKE negotiation. Where necessary, these ESP packets are encapsulated in an additional IP header, so preventing VPN connections from being interrupted by devices which don't carry out IPsec masquerading
New UMTS cards	With LCOS 5.20 and an activated UMTS/VPN option, the LANCOM 3550 Wireless now supports the following UMTS data cards: Novatel Wireless U530 and U630, Option GT 3G Fusion and Option GT 3G Quad.
IEEE 802.11h	In Europe, compliance with the ETSI standard is a prerequisite for operating 5-GHz WLAN connections with the maximum approved transmission power of 100mW, and LANCOM has supported the necessary mechanisms (e.g.TPC and DFS) for some considerable time already. We have now supplemented this with improved channel swapping according to IEEE 802.11h.
HTTPS remote configuration	LANconfig now additionally supports encrypted remote configuration via HTTPS. This offers AES 256-bit protection when updating configurations or when uploading scripts and firmware. For remote maintenance without encryption (e.g. when using ISDN direct dial-in, or inside a VPN), HTTP can be used as an alternative to TFTP, thus enabling faster data transmission during remote management.
PPPoE Server	Layer-2 authentication of users or user groups with PPPoE clients is now supplemented by a PPPoE server function.
WLAN bandwidth limitation	The maximum allowable WLAN transmit and receive data rates can be limited on a per-client basis.
LAN / DMZ intrusion prevention	The IP address checks of the intrusion detection module can now be applied to LAN and DMZ interfaces and allocated network zones. The "strict" setting only accepts IP addresses allocated to the interface.
Spanning Tree	The Spanning Tree protocol helps Ethernet devices in any meshed network to establish redundant paths without undesirable loops.
Per client VLAN-ID	A separate VLAN-ID can be allocated to each WLAN client.
DHCP client IDs	When acting as a DHCP client, a LANCOM can supplement transmitted DHCP requests with a device name in the form of a vendor class identifier. User-specific information can be transmitted as a user class ID.
WAN RIP propagation	Dynamic routing entries learned by RIP can now be propagated over the WAN, too. A masquerading method and a routing tag can optionally be defined for each remote site.

Functions as of LCOS 6.02

LCOS 6.02 LANCOM OPERATING SYSTEM

SIP proxy*	Management of local SIP users with optional automatic registration/authentication. Mapping of public SIP-provider accounts for shared use. Connection to up to four upstream SIP PBXs including line backup. SIP connections from/to internal subscribers, SIP providers and SIP PBXs with automatic login of SIP users at SIP providers/upstream SIP PBXs. Optional shared/individual password for authentication at an upstream SIP PBX. Automatic bandwidth management and automatic configuration of the firewall for SIP connections. Backup connections via ISDN if the SIP line is unavailable; set in the VoIP Call Manager (VCM). Default DNS entry for the local SIP domains, support of service location records (SRV) especially for SIP.
SIP/ISDN gateway*	Operation direct at ISDN exchange lines or at ISDN extension lines of existing PBXs. Local ISDN subscribers register as local SIP users, and local ISDN subscribers automatically register as SIP users at upstream SIP PBXs. Number translation between internal numbers and MSN and automatic adaptation of caller numbers and called numbers at the transition. ISDN supplementary services CLIP, CLIR, en-block dial, individual dialing with adjustable wait time until completion.
VoIP Call Manager (VCM)*	Central switching of all incoming and outgoing calls. Number translation by mapping, numeral replacement and number supplementation. Configuration of line and route selection, entry of multiple alternative routes (line backup). Routing based on calling and called number, SIP domain and line. Manual routing by the user ("outside-line access codes"); routing with line-selection keys on telephones or telephone number prefixes; targeted routing for individual telephone numbers (e.g. emergency calls via local ISDN); separate routes for internal, local, long-distance or international calls; blocking of telephone numbers or blocks of telephone numbers; inclusion of local SIP and ISDN subscribers into the number range of upstream SIP PBXs; internal standard telephone number for undeliverable calls; supplement/remove line-related dialing prefixes or trunk numbers.
VoIP Setup Wizard*	Installation Wizard in LANconfig for connections to SIP providers, SIP PBXs, SIP subscribers, ISDN subscribers and ISDN PBXs, and VCM configuration.
VoIP monitoring*	Status display for VoIP subscribers, lines and connections; VoIP trace in the command-line interface.
VoIP processing*	G.168 echo cancellation, adaptive de-jitter buffer, inband tone signaling to the German standard, transparent pass-through for negotiated codecs, interaction on codec negotiation between subscribers (filtering, optimization for quality or bandwidth), voice coding to G.711 (a-law, u-law, 64 kbps) or G.726 (16, 24, 32, 40 kbps).
VoIP Quality of Service*	QoS adapted for voice connections with dynamic bandwidth reservation per connection and automatic selection of the voice compression method. Prioritization (CoS), and DiffServ marking of voice packets, traffic shaping (incoming/outgoing) and packet-size management of non-prioritized connections compared to VoIP
Extended UMTS support	In combination with the UMTS/VPN option, the "HSDPA-ready" UMTS cards Option GT 3G+ are supported (e.g. T-Mobile "Mobile DSL Card").

Functions as of LCOS 6.10

LCOS 6.10 LANCOM OPERATING SYSTEM

ISDN point-to-point connection*	In addition to the support of ISDN point-to-multipoint connections, LANCOM now also supports ISDN point-to-point connections. Multiple connections can be collected together under a root number and extensions
SIP trunking *	By using SIP trunking (ITU Q.1912), an appropriate SIP account can be used by multiple subscribers, each of which has an individual extension number.
SIP remote gateway*	The ISDN interface of a LANCOM router with VoIP functions can be used as a local dial-in or dial-out point, for instance by a central VoIP PBX.
Layer 2 / Layer 3 tagging	The prioritization information in 802.1p VLAN frames on Ethernet (layer 2) can be set as layer 3 attributes (DiffServ), enabling prioritization information to be transmitted from end to end along routes. Terminal devices emitting packets with 802.1p-tagged frames will be answered with 802.1p frames.
802.11e / WME	Support of wireless LAN Quality of Service according to Wireless Multimedia Extensions (WME) for prioritization in WLANs.
RADIUS server	A WLAN access point with integrated RADIUS server can make its access control list (MAC address filter) available to further access points.
Certificate Revocation Lists	With a revocation list, certificates can be revoked prior to their expiry date. LANCOM VPN gateways with CRL support can query certificate authority CRLs via HTTP, either at regular intervals or briefly before a certificate is due to expire.
RAS user template	All certificate-controlled VPN client connections in Config Mode can now be operated via a single configuration setting (RAS user template). It is no longer necessary to create configuration files on a per-client basis.
USB printer port	Enables USB printers to act as network printers. Support of RAW and LPR protocols. Bidirectional data exchange, for example to send messages about toner level. Parallel print jobs are saved on the PCs and processed in sequence.
ISDN leased lines	As of this version, the formerly optional leased-line support is now a standard feature in all devices featuring ISDN.
Extended UMTS support	In combination with the UMTS/VPN option, the "HSDPA-ready" UMTS cards Option GT Fusion+ and Option GT max are supported. (Update: This option is activated as standard on all LANCOM 3550 Wireless models as of LCOS 6.14.)

Functions as of LCOS 6.24

LCOS 6.24 LANCOM OPERATING SYSTEM

WLANmonitor	The new WLANmonitor detects and displays rogue WLAN access points. Displayed information includes: channel occupied, network name, WLAN MAC address, encryption method and signal strength at the access points which detected the rogue AP or client.
WLAN background scanning	The detection of rogue access points and channel properties is carried out almost unnoticeably (few ms) for all WLAN channels during normal AP operation.
WLAN client detection	Rogue WLAN client detection based on probe requests.
Fast client roaming	With background scanning, mobile access points in client mode can switch to alternative access points which offer a better signal before the connection to the first access point fails.
WPA2 fast roaming	Pre-authentication and PMK caching for fast 802.1x authentication
LED display for signal quality	In addition to the standard display (the number of associated clients), devices can now directly display the signal strength of a WLAN client or over a point-to-point connection. This can be of help when setting up transmission paths, for example.
802.1x supplicant	Authentication of an access point in WLAN client mode at another access point via 802.1x (EAP-TLS, EAP-TTLS and PEAP).
Automatic daylight-saving time	Although the NTP module internally works with UTC, the local time can automatically be adjusted for daylight-saving time.
Accounting snapshot	Snapshot function for regular exact read-outs of values (connection time, online time, transfer volumes per station) at the close of a billing period.
Public key SSH	Certificate-based SSH authentication (alternative to PSK)
Proadaptive VPN	Proadaptive VPN Automated configuration and dynamic creation of all necessary VPN and routing entries based on a default entry for site-to-site connections. Propagation of dynamically learned routes via RIPv2, if required.
VPN certificate requests	Extended Cisco interoperability in certificate-based IPSec installations by supporting an optional "CERTREQ" request.
New VoIP codecs	Optimal voice coding with G.729 as a low-bitrate codec, for example for WAN connections over ADSL, and with the G.722 high-quality codec between ISDN and SIP. The codecs are available for all "VoIP integrated" devices and for "VoIP ready" devices with the Advanced VoIP option.
DTMF tone dialing	Tone dialing (DTMF) by means of RFC 2976 (SIP INFO) or RFC 2833 (RTP payload for DTMF digits).
AOC support	Transmission of AOC (advice of charge) information between the internal and external ISDN interfaces with appropriate "VoIP integrated" products. Two types are supported: AOC-D for advice of charge during a call, and AOC-E for advice of charge at the end of a call.

Functions as of LCOS 7.20

LCOS 7.20 LANCOM OPERATING SYSTEM

VoIP PBX*	PBX functions integrated into all LANCOM VoIP routers: Hold call, transfer call, connect call to and from any internal and external subscriber (SIP, analog, ISDN); call forwarding immediately, on busy or after a wait time for all internal subscribers; suppression of second calls (busy-on-busy); group calls with parallel or sequential ringing (group cascading); FAX over with T.38; multi-login to reach a subscriber via multiple terminal devices using one telephone number
1-Click-VPN	"1-Click VPN" for VPN-connection configuration between LANCOM routers by drag&drop in LANconfig. "1-Click VPN Client" for simple configuration of VPN-client dial-in, including automatic generation of an import profile for LANCOM Advanced VPN Client by LANconfig
Advanced Routing and Forwarding (ARF)	Virtualized LANCOM routing engine: Depending on the device, up to 64 independent routing contexts can be provided, each with independent interfaces, IP networks, VLANs, rules for routing, firewall and QoS, DHCP server, DNS settings, etc. Dedicated firewall rules can allow a controlled transition between these (normally strictly separated) contexts for shared use of IP infrastructure (server, printer, etc.).
SCEP	Automatic creation, rollout and renewal of certificates via SCEP (Simple Certificate Enrollment Protocol) In combination with LANCOM Pro-Adaptive VPN, self-configuring certificate-based networks can be rolled out fully automatically.
Integrated RADIUS/EAP server	Integrated RADIUS/EAP server for self-sufficient 802.1x authentication with EAP-TLS, EAP-TTLS, PEAP, MSCHAP and MSCHAPv2.
Rapid Spanning Tree	Support of rapid spanning tree for fast path resolution in case of redundant layer 2 connections.
WLAN client roaming improvements	New expert settings for fine tuning the roaming behavior when in WLAN client mode
WLAN Controllers	As of LCOS 7.20, all LANCOM WLAN access points and WLAN routers support operations with LANCOM WLAN Controllers.

Uninterrupted 5 GHz WLAN connections with DFS	As of LCOS 7.20, the limitation requiring 5-GHz outdoor radio paths operated with DFS to be interrupted for one minute every 24 hours no longer applies. The connection can now be operated for any length of time on the channel selected by the DFS algorithm until a radar signal is detected.
Extended port forwarding	Inverse masking can now be defined for multiple IP addresses and can be bound to TCP and/or UDP.
HTTP tunnel for remote-maintenance access	A TCP/HTTP tunnel can be used to access LAN devices after authentication.
Extended VLAN support	Support of Ethernet frames with multiple VLAN tags (Q-in-Q) and support of VLAN over (V)DSL WAN connections
Fuzzy CRON actions	Timed control can be varied, for example, for the staggering of time-controlled connections to multiple devices.
New UMTS cards	Support for UMTS cards "Option GT 3G CDMA - HSDPA 7.2 Ready" and "web 'n' walk ExpressCard II (Option GE0201)"
Configurable reset button	The behavior of the reset button is configurable (reset & boot, boot only, or ignore) for the protection of devices in public areas.
Bridge groups	Interfaces such as Ethernet ports, SSIDs or point-to-point connections can now be individually connected to one another through multiple bridges.

New functions with LCOS 7.5:



WLAN controller 802.11n access point support	Direct support of the LANCOM L-300 series Access Points via LANCOM WLAN Controller (without additional licenses)
WLAN Controller firmware deployment	Central firmware distribution to multiple LANCOM wireless routers and LANCOM access points by the WLAN Controller (firmware provision from web server required). Automatic Firmware update on the Access Points is also possible. The Controller checks every day, depending on the defined policy, for the latest Firmware and compares it with the versions in the devices. This can also be activated using Cron jobs. If there is a Firmware mismatch, then the Controller downloads the matching Firmware from the server and updates the corresponding Access Points and Routers
WLAN Controller script distribution	Enables the complete configuration of non-WLAN specific functions such as redirects, protocol filter, ARF etc.
WLAN Controller RF management and automatic RF optimization	The channel deployment can be static or can be automated. Upon activation of the RF Optimization setting, the Access Points search for an optimal channel in the 2.4 GHz band. The selected channels are sent to the Controller which saves these channels on the corresponding Access Points. RF Optimization can also be activated for individual Access Points. Transmit power setting static between 0 to -20 dB. Alarm notification in case of Access Point failure by LED, e-mail, SYSLOG and SNMP traps
WLAN Public Spot	Easy set-up of guest accounts with just a few mouse clicks using the Voucher-Wizard. The vouchers can be printed over any standard printer on the network. The Voucher-Wizard can be adapted to the hotel or clinic by uploading the individual logo. Function works without external RADIUS and accounting servers
LANconfig	Revised wizards for basic settings, Internet and WLAN. Preferences for LANconfig can be saved and restored per user or globally for several users or per project. The new multi-column view allows for immediate overview of core device information (name, description, address, device status, progress, device type, hardware release, serial number, MAC address, firmware version, FirmSafe, 1. image version, 2. image version). Columns can be hidden and the view can be sorted by each column. From LCOS 7.54: Automatic storage of the current configuration before firmware updates, detection and display of the new LANCOM ES-2126/ES-2126P managed switches.
LANmonitor	Advanced diagnostic functionality with TRACES directly from within LANmonitor. Convenient dialog windows for configuration and filter settings for output. Revocation of certificates within LANmonitor. Sorted view of VPN connections. From LCOS 7.54: Search function within TRACE tasks. Monitoring of the new managed switches LANCOM ES-2126/ES-2126P
WEBconfig	New setup wizards for Internet configuration, WLAN and Public Spot Management rollout wizard Rollout support for LANCOM devices in large scale projects.
Management Rollout Wizard	Support for large project rollouts. After pre-configuration with basic settings, the LANCOM device is provisioned with a project- and location specific configuration when installed on location
VoIP Media Proxy *	Termination and interconnection of multiple media streams. Control of SIP-connection media sessions. IP address and port translation for media stream packets. Connection of parties at media stream level where a call transfer in SIP (REFER) is not possible.
Dynamic routing	Extended RIPv2 including HopCount, Poisoned Reverse, Triggered Update for LAN (acc. to RFC 2453) and WAN (acc. to RFC 2091) as well as filter options for propagation of routes
Specific DNS forwarding	Separate entry for backup DNS servers per forwarding rule
VPN certificates	Support for digital, multi-level X.509 certificates, compatible with Microsoft Server/Enterprise Server and OpenSSL. Now certificate hierarchies are supported when the certificates are uploaded in a single PKCS#12 file via WEBconfig (HTTPS) or LANconfig
RADSEC	Secure communication between RADIUS server and client with certificate based authentication

WLAN point-to-point connections	Radio modules with assigned names (radio ID). Now the configuration of point-to-point connections allows to use the radio IDs as references instead of MAC addresses
WLAN background scanning	Custom adjustment of scanning time/filter for faster roaming decisions
DFS	Conformance to DFS as of ETSI 301 893 version 1.3 for all WLAN devices with 5 GHz radio brought to market from April 2008 on 5-GHz radio modules
Dynamic DNS update with GnuDIP client	As of LCOS 7.54, the GnuDIP protocol is supported for updating DNS servers with dynamic IP addresses. The protocol offers security that is superior to DynDNS (Salt and MD5 Digest). The GnuDIP server with self-signup functions and DNS Dynamic Update Protocol for DNS servers is available as open-source software
Firmware compression	A new compression algorithm improves the use of flash ROM for firmware storage with LCOS 7.54
SIP proxy*	Support of early and late initiation of SDP negotiation (as of LCOS 7.56)
ADSL multi-mode	New ADSL line code and support of various line codes for ADSL, ADSL2 and ADSL2+ in one firmware (as of LCOS 7.56)

New functions with LCOS 7.6:

LCOS 7.6

LANCOM OPERATING SYSTEM

Router / ARF	Automatic learning of routing tags for ARF contexts from the routing table
Firewall	New trigger for firewall rules depending on backup status, e.g. simplified rule sets for low-bandwidth backup lines
QoS / session limits	Limitation of the number of session per remote site (ID). Setting relative bandwidth limits for QoS in percent. Bandwidth control and QoS also for UMTS connections
RIP	The names of RIP sources can use wildcards, which simplifies the configuration in large installations
PPP	Setting of the protocol for PPP authentication. MS-CHAPv2 support. Optional connection to RADIUS server for MS-CHAPv1 and MS-CHAPv2
COM-port server and forwarding	COM-port server for DIN and USB interfaces on LANCOM routers and access points. For multiple serial devices connected to it, the server also manages its own virtual COM ports via Telnet (RFC 2217) for remote maintenance (works with popular virtual COM-port drivers compliant with RFC 2217)
IPSec VPN backup	Backup of VPN connections across different hierarchy levels, e.g. in case of failure of a central VPN concentrator and re-routing to multiple distributed remote sites. Any number of VPN remote sites can be defined (the tunnel limit applies only to active connections)
Certificates	New OpenSSL implementation with FIPS-140-certified algorithms. Secure Key Storage protects a private key (PKCS12) from theft
XAUTH	XAUTH client for registering LANCOM routers and access points at XAUTH servers incl. IKE-config mode. XAUTH server enables clients to register via XAUTH at LANCOM routers
WLC monitoring & management	Standardized and combined monitoring view of WLAN Controller clusters. Internal storage of up to three script files (max. 64K) for provisioning access points without a separate HTTP server. Automatic monitoring of all devices in a cluster simply by selecting one controller in the cluster
Public Spot	Support of public certificates and certificate chains from positions of trust for Public Spots. This allows popular browsers to access trustworthy login pages with secure access (HTTPS) without warnings from LANCOM devices.
SIP registrar *	Configurable registration (with/without) and line monitoring (inactive, automatic, with re-registration, with OPTIONS requests) for SIP trunk, link, remote gateway and SIP-PBX line
SIP proxy*	Switchable support of privacy/call screening (call number suppression) per line compliant with RFC 3325 or with remote party ID. Implementation depending on subscriber settings (CLIR). Support of Request URI (RFC 3261)
New WEBconfig	Completely reworked Web interface for LANCOM router and access point configuration. Similar to LANconfig with a system overview, syslog and events display, symbols in the menu tree, quick access with side tabs. WEBconfig now also features new Wizards for basic configuration, security, Internet access, LAN-LAN coupling + online help
HTTPS client	For downloading firmware and configuration files from an HTTPS server, e.g. for roll-out management
New firewall GUI	New graphical user interface for configuring the object-oriented firewall in LANconfig: Tabular presentation with symbols for rapid understanding of objects, choice of symbols for objects, objects for actions/Quality of Service/remote sites/services, default objects for common scenarios, individual object definition (e.g. for user groups)
Simplified config management	Exchange of configuration files between similar devices, e.g. for migrating existing configurations to new LANCOM products. New, non-modal help window that can dock with the configuration window. Context-sensitive help display. Configurable tool bar (add/remove symbols, size settings, show/hide subtitles) with new symbols for storage and properties.
LANmonitor	Optimized, sorted display of VPN connections. Display and storage of internal Syslog buffer (events) from LANCOM devices
Trace Wizard / diagnosis files	Improvement of graphical TRACES with Wizards for standard diagnostics. Export of diagnostic files for support purposes (including boot-log, sysinfo and device configuration without passwords)

* Available with the business-VoIP routers LANCOM 1722/1723/1724/1823 VoIP only.

LANCOM Software Options

LANCOM VPN-25 Option	<p>IPSec based VPN for highest security requirements</p> <ul style="list-style-type: none"> • Upgrade to 25 active VPN channels • LANCOM Dynamic VPN extensions – for VPNs with dynamic IP addresses • Encryption methods 3-DES, AES, Blowfish, CAST and DES • Easy commissioning with Setup Wizards <ul style="list-style-type: none"> • LANCOM 1600 series • LANCOM 1800 and 1700 series (incl. activation of 3-DES/AES hardware encryption) • LANCOM 3000 series
LANCOM VPN-500 Option	<p>Upgrade to 500 simultaneous channels for IPSec-based VPN</p> <ul style="list-style-type: none"> • LANCOM 8000 series
LANCOM VPN-1000 Option	<p>Upgrade to 1000 simultaneous channels for IPSec-based VPN</p> <ul style="list-style-type: none"> • LANCOM 8000 series
LANCOM WLC-12 Option	<p>Upgrade to 12 managed access points</p> <ul style="list-style-type: none"> • LANCOM WLC-4006
LANCOM WLC-50 Option	<p>Upgrade to 50 managed access points</p> <ul style="list-style-type: none"> • LANCOM WLC-4025
LANCOM WLC-100 Option	<p>Upgrade to 100 managed access points</p> <ul style="list-style-type: none"> • LANCOM WLC-4025
LANCOM Public Spot Option	<p>Software option ideal for use in wireless Internet services at public places such as airports, hotels, railway stations, restaurants, cafés or universities</p> <ul style="list-style-type: none"> • User authentication and billing for public wireless LANs • RADIUS based AAA support • Walled Garden • WDS (Wireless Distribution System) • Blind mode (layer 2 user isolation) • Secure authentication via SSL (HTTPS) • Integrated voucher printing wizard – printing of WLAN access vouchers via standard network printer • Individual design of the Web pages by templates <ul style="list-style-type: none"> • Software option for all LANCOM wireless access points and WLAN routers
LANCOM WLC Public Spot Option	<p>New central Public Spot functions for WLAN Controllers</p> <ul style="list-style-type: none"> • LANCOM WLC-4025
LANCOM VoIP-32 Option	<p>Upgraded for 32 local SIP subscribers for business VoIP routers</p> <ul style="list-style-type: none"> • LANCOM 1722 VoIP • LANCOM 1723 VoIP • LANCOM 1724 VoIP • LANCOM 1823 VoIP
Accessories	<ul style="list-style-type: none"> • LANCOM Advanced VPN Client for Windows 2000, XP and Vista, single user license • LANCOM Advanced VPN Client for Windows 2000, XP and Vista, 10 user licenses • LANCOM Advanced VPN Client for Windows 2000, XP and Vista, 25 user licenses
Config Service Ticket-1 Config Service Ticket-5 Config Service Ticket-10 Config Service Ticket-100	<p>Direct access to technical expertise and practical experience with LANCOM Premium Support</p> <ul style="list-style-type: none"> • Conceptualization of solution scenarios • Creation of configurations and remote support • Direct calling with call back and guaranteed reaction times • One ticket is charged per question and per hour or part thereof <ul style="list-style-type: none"> • For all LANCOM products
LANCOM Reference Manual	<p>The LANCOM LCOS 7.6 Reference Manual and LCOS 7.6 Addendum offers you an overview of all functions ordered according to model and LCOS version.</p>

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