Setup Guide: LANCOM XS-6128QF configuration options

The LANCOM XS-6128QF is designed to operate as an aggregation switch in hierarchical switch infrastructures transporting high data volumes. With a maximum switch capacity of 1 Terabit, the device operates either as a collapsed core in two-tier networks or as a distribution switch in three-tier networks. The switch uses only industry-standard interfaces and does not use costly modular construction. The use of Combo and FleX ports allows for the cost-efficient implementation of multi-Gigabit infrastructures.

This tech paper highlights the basic specifications of the LANCOM XS-6128QF along with port and network requirements as well as relevant application scenarios.

This paper is part of the **series "switching solutions"**.
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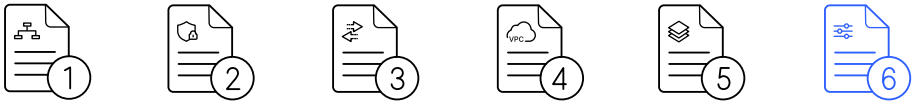

Basics
Two-tier & three-tier switch architectures

Basics
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Setup Guide
Konfigurations-optionen LANCOM XS-6128QF

At a glance

→ The LANCOM XS-6128QF offers four configurable board types:
- Board type 1 – 4× 25G SFP28 / 4× 50G SFP-DD (default)
- Board type 2 – 2× 40G QSFP+ / 4× 50G SFP-DD
- Board type 3 – 4× 25G SFP28 / 4× 25G SFP28
- Board type 4 – 2× 40G QSFP+ / 4× 25G SFP28

→ The main difference between the board types is how the 25G SFP28 or 40G QSFP+ ports are configured:
- For a stack at a single location: Board type 1 or 2
- For a stack at different locations (decentralized): Board type 3 or 4

→ Board types 1 & 2 or board types 3 & 4 can each be combined into a stack of multiple switches.

→ If no stacking is used, the rear ports of the board types 3 & 4 can be used as normal 25G Ethernet ports.

→ Changing the board type requires a restart.

LANCOM XS-6128QF specifications

- → Multi-Gigabit aggregation switch with 20× 10G SFP+ downlink ports, including 4x multi-Gigabit combo ports (10G SFP+ or 1G / 2.5G / 5G / 10G nBASE-T), plus 4 additional 10G SFP+ ports when using 10G SFP+ modules in the 4× 25G SFP28 ports
- → FleX uplink ports (4× 25G SFP28 or 2× 40G QSFP+)
- → Non-blocking backplane stacking via 4 dedicated 50G SFP-DD-FleX ports
- → Full layer-3 functionality through VRRP, DHCP, static and policy-based dynamic routing via OSPF v2/v3 and BGP4
- → Redundant, hot-swappable PSU and 2 hot-swappable fans for highest availability
- → Front-to-back airflow for optimal cooling in 19” racks
- → Security with configurable access control on all ports as per IEEE 802.1X and access control lists
- → Secure remote management through TACACS+, SSH, SSL, and SNMPv3
- → Cloud-managed LAN and switch stacking for fast configuration and convenient management via the LANCOM Management Cloud
- → Includes a Limited Lifetime Warranty (LLW)

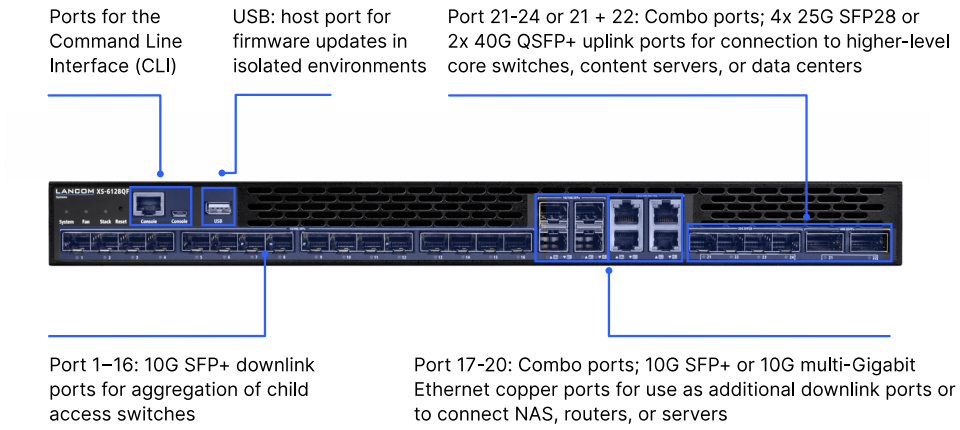

Figure 1a:
LANCOM XS-6128QF port layout

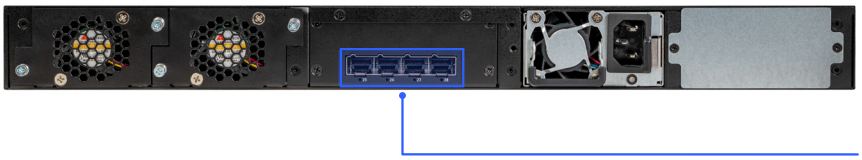

Figure 1b:
LANCOM XS-6128QF port layout (rear panel)

LANCOM FleX vs. combo ports

LANCOM “FleX ports” are interfaces that can fulfill various tasks in the network topology and are configured according to the particular board type. These tasks include, on the one hand, the logical network directions “downlink” and “uplink” or, on the other hand, the physical configuration as Ethernet or stacking ports. Configuration changes between the different board types affect both the port types and the port speeds. This requires a **reboot to initialize**. Configuration options such as VLAN, LACP, etc. are only available when they are configured as Ethernet ports.

Changing the ports for the “combo port” (shown in Abbildung 1a and 1b under ports 17–20) does not require a reboot. These combo ports follow the either-or logic in accordance with the IEEE standard and automatically recognize whether connections need to be established via the four 10G SFP+ ports or the four 10G nBASE-T ports. The 10G SFP+ ports always take priority here. This means that the switch only activates the 10G copper ports when all four of the associated 10G SFP+ ports are unused. A combined operation of the interfaces mentioned is therefore not possible in this case.

Port usage

The **SFP+ or multi-Gigabit Ethernet 10G ports** (ports 1–20) are intended for the aggregation of lower-layer access switches. They are primarily for use as downlink ports, and they support LACP groups with up to 10 ports, i.e. for a total of 100 Gbps.

The **4× 25G SFP28 or 2× 40G QSFP+ FleX ports** are primarily intended to be a high-performance uplink to a third switch layer (core or backbone). They enable port capacities of up to 100 Gbps, which is achieved by bundling the 4x SFP28 (25G) via LACP by means of a fanout cable.

If the upper-layer backbone or core switch in this three-tier network scenario has 40G QSFP+, i.e. 40G connections, the alternative 2× 40G QSFP+ ports of the XS-6128XP are selected to yield an uplink of 80 Gbps.

Furthermore, these ports can also be configured as additional downlink ports. If the switch is operated as a so-called collapsed core directly at the router, an uplink is not strictly required. Instead, the larger number of connections can be made available to the lower-tier access layer. It should be mentioned that these front-facing 25G SFP28 ports do not operate exclusively as 25G links, but optionally as 10G links.

The **four 50G SFP-DD FleX ports on the rear** (ports 25-28) primarily support the stacking function. Up to 200 Gbps stacking-port capacity using four LANCOM SFP-DD-DAC50 or Direct Attach Cable stacking cables provides what is referred to as a non-blocking stacking architecture. Here, the total downlink capacity corresponds to the total stacking capacity. This means that this usage variant prevents bottlenecks, even when operating a full stack of up to eight LANCOM XS-6128QFs.

If the four rear-mounted 50G SFP-DD FleX ports (which comply with industry standards) are configured as 25G SFP28 ports, then combining them with LANCOM SFP-LR-LC25 or SFP-SR-LC25 modules provides decentralized stacking, i.e. stacking with optical transceivers over long distances, i.e. up to 10 km away.

If the network topology does not use stacking, for example because there is only one XS-6128QF in the network or it is operated as a distribution switch, the 50G SFP-DD FleX ports when configured as 25G SFP28 ports can alternatively be used as a downlink, i.e. for connecting access switches with 25G uplink ports. Configuring a link to 10G is not supported on the 50G SFP-DD FleX ports.

Board configuration options

The LANCOM XS-6128QF allows the various usage types outlined above to be set by configuring different board types, which are described in detail below. Each of the four supported board types is easily set via CLI or WebGUI. While board types in a switch are easily changed, and it is equally easy for different board types to be combined within a stack. Note that activating any changes to the board type requires a restart with reboot.

Board type 1 – 4× 25G SFP28 / 4× 50G SFP-DD (default)
Aggregation switch with 28 ports

→ 16× 10G SFP+ and 4x multi-Gigabit combo ports (10G SFP+ or 1G/2.5G/5G/10G nBASE-T)
→ 4× 25G SFP28 FleX ports (1G/10G/25G)
→ 4× 50G stacking via SFP-DD-DAC50 stacking cable in 50G SFP-DD FleX ports

Board type 2 – 2× 40G QSFP+ / 4× 50G SFP-DD
Aggregation switch with 26 ports

→ 16× 10G SFP+ and 4x multi-Gigabit combo ports (10G SFP+ or 1G/2.5G/5G/10G nBASE-T)
→ 2 × 40G QSFP+ ports
→ 4× 50G stacking via SFP-DD-DAC50 stacking cable in 50G SFP-DD FleX ports

Board type 3 – 4× 25G SFP28 / 4× 25G SFP28
Aggregation switch with 28 ports

→ 16× 10G SFP+ and 4x multi-Gigabit combo ports (10G SFP+ or 1G/2.5G/5G/10G nBASE-T)
→ 4× 25G SFP28 FleX ports (1G/10G/25G)
→ 4× 25G decentralized stacking via LANCOM SFP-LR-LC25 or SFP-SR-LC25 or use as 4× 25G SFP28 Ethernet ports

Board type 4 – 2× 40G QSFP+ / 4× 25G SFP28
Aggregation switch with 26 ports

→ 16× 10G SFP+ and 4x multi-Gigabit combo ports (10G SFP+ or 1G/2.5G/5G/10G nBASE-T)
→ 2 × 40G QSFP+ ports
→ 4× 25G decentralized stacking via LANCOM SFP-LR-LC25 or SFP-SR-LC25 or use as 4× 25G SFP28 Ethernet ports

Port configuration options

The board configuration options “Board type 1” and “Board type 3” outlined above allow 25G and 10G modules to operate on the front-facing 25G SFP28 ports. This increases the number of optional port configurations from four to six. The various configuration options and the resulting number of ports are shown again in the overview below:

		XS-6128QF switch ports				Port combinations			
		10G SFP+ (combo)	25G SFP28	40G QSFP+	50G SFP-DD				
Option	**Board type**	**Port bandwidth used**				**10G**	**25G**	**40G**	**50G**
1	1	20× 10G	4× 25G		4× 50G	20	4		4
2	1	20× 10G	4× 10G*		4× 50G	24			4
3	2	20× 10G		2× 40G	4× 50G	20		2	4
4	3	20× 10G	4× 25G		4× 25G**	20	8		
5	3	20× 10G	4× 10G*		4× 25G**	24	4		
6	4	20× 10G		2× 40G	4× 25G**	20	4	2	

* via 10G transceiver in the 25G SFP28 port, ** via 25G SFP28 transceiver in the 50G SFP-DD port

Configuration changes and combinations in the stack

The different board configurations are easily selected using the WebGUI or CLI. As shown above, the board configuration “Board type 1” is the default on delivery. This also means that, ex-factory, the two 40G QSFP+ ports on the front are not activated in favor of the four 25G SFP28 ports on the front. To change between these port variants, it is essential to switch to the board configuration “Board type 2”.

The selection menu is located on the “Board Type” tile on the dashboard landing page after you log in.

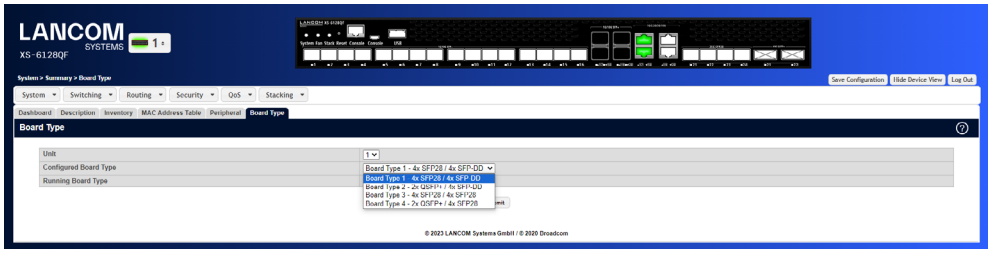

Figure 2:
WebGUI selection menu for board types

If you plan to or already operate a stack, the “Unit” selection field shown in Abbildung 2 can be used to select each stack member in turn. The drop-down menu is then used to set the board types. For combined operations running different board types within a stack, you should be aware that the stack will break if you select board types with different stacking ports. The following combinations of board types within a stack are possible:

→ Combined operation of “**Board type 1** – 4× 25G SFP28 / 4× 50G SFP-DD” with “**Board type 2** – 2× 40G QSFP+ / 4× 50G SFP-DD”

→ Combined operation of “**Board type 3** – 4× 25G SFP28 / 4× 25G SFP28” with “**Board type 4** – 2× 40G QSFP+ / 4× 25G SFP28”

If a CLI terminal connection is your preferred configuration tool, the board types can be set and adjusted using the CLI command “board-type”.

```
(XS-6128QF)(Config)#board-type ?
<name>                    Enter Board Type number: 1: 4x SFP28 and 4x SFP-DD;
                          2: 2x QSFP+ and 4x SFP-DD; 3: 4x SFP28 and 4x SFP28;
                          4: 2x QSFP+ and 4x SFP28
```

Figure 3:
Board-type CLI commands

Please note: For existing stacks, this command has to be executed separately for each switch unit.

Scenario for using “Board type 1” and “Board type 2”

To illustrate these options in practice, we assume the following scenario: The LANCOM XS-6128QF is operated in a stack of eight, either in a network with a redundant connection to a data center, or as a distribution switch between the access layer below it and the core layer/backbone layer above it. This network design is suitable, for example, for campus networks in many parts of a building, but also in large enterprise networks with thousands of employees in multi-storey building complexes.

Stacking is implemented by the 4× 50G SFP-DD ports on the rear. The high-speed, redundant uplink to the data center or the backbone is implemented via the FleX uplink ports on two of the eight switches. When using the default board type 1, a 100-Gbps uplink could be implemented for each switch by using the 4× 25G SFP28 ports (i.e. 200 Gbps with two switches). By using board type 2 instead, an 80 Gbps uplink can be realized for each switch (i.e. 160 Gbps with two switches) by using LACP and LAG port groups; each switch then establishes two 40G uplinks to the data center.

In this case, each LANCOM XS-6128QF provides 20× 10G downlink ports for the aggregation of access switches. In a stack of eight, this corresponds to 8×20 or 160 10G downlink ports.

If you also add the free 25G SFP28 FleX uplink ports on six of the eight switches in the stack, then using the preset board type 1 provides an additional four 10G/25G downlink ports. This increases the number of downlink ports by a further 6×4, i.e. 24. Overall this corresponds to **184 downlink ports**, which can be used to aggregate an equivalent number of access switches. In the case of the LANCOM GS-3152XP access switch, which provides 48 1G ports, this results in networks with 184×48 or **8,832 ports**.

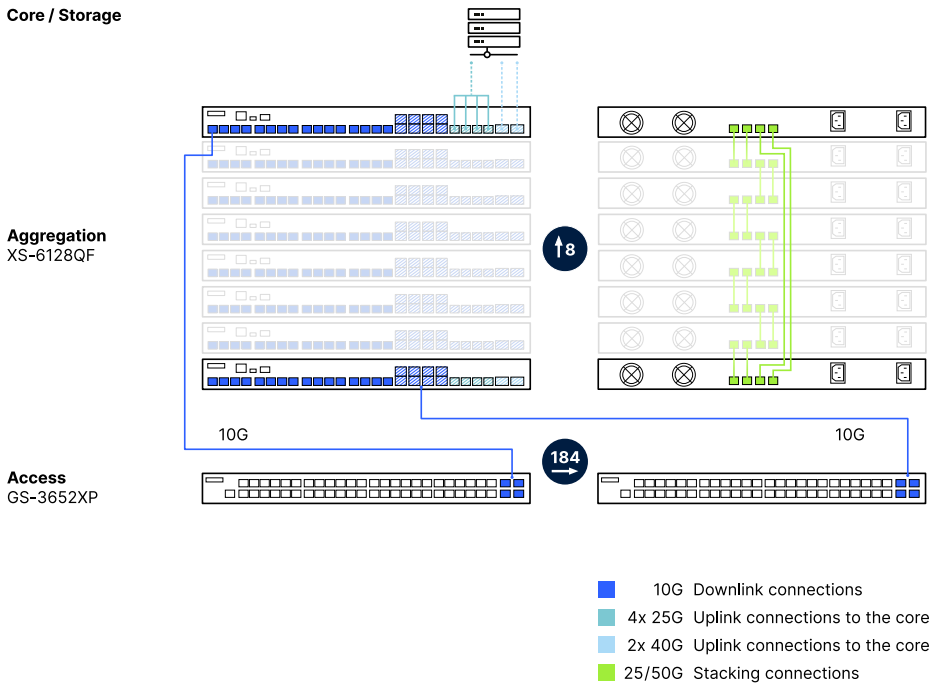

Figure 4:
Example scenario, board type 1+2 without redundancy

In redundancy scenarios, where each access switch is connected to the aggregation layer by two 10G ports, this allows for networks with 184×48/2, i.e. **4,416 ports**. Note that when using LACP, i.e. LAG port groups, the two individual connections are divided between at least two XS-6128QFs in the stack. The only ports on the stack that have to be specified are those belonging to this LAG group; the stacking protocol takes care of the rest by itself.

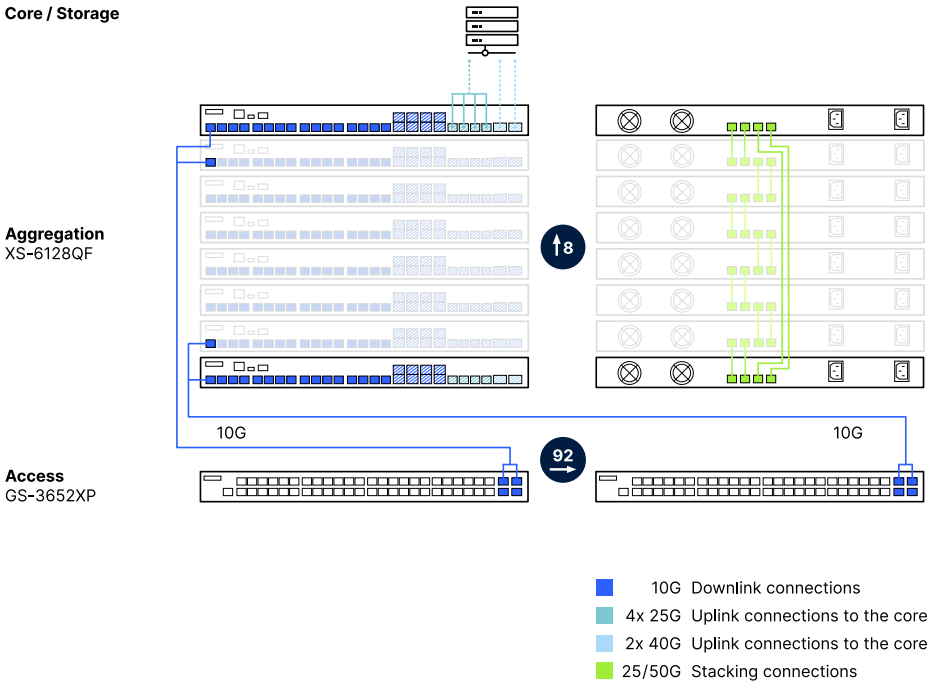

Figure 5:
Example scenario, board type 1+2 with redundancy

Scenario for using “Board type 3” and “Board type 4” – decentralized stacking

Let us take the same enterprise network once again but this time with the added requirement to distribute the member switches of a stack across remote parts of the building, and to manage these as a single IP address. This is known as decentralized stacking. This function is supported by board types 3 and 4 of the LANCOM XS-6128QF, which reconfigure the rear-facing 50G SFP-DD FleX ports as 25G SFP28 ports and which support the use of single- or multi-mode 25G SFP28 transceivers. With single-mode optics, locations can be networked that are up to 10 km apart. Multi-mode optics allow for up to 300 m between neighboring buildings. Abbildung 6 shows an example of decentralized stacking. In addition to a main building, the stack is distributed across two additional outbuildings. In this example, the main building has 96 access switches, which, if the GS-3652XP is used again, results in **4,608 access ports** (48×96). In the outbuildings, a total of 48 access switches then results in **2,304 ports**. Using redundant cabling between the access switches and the aggregation layer, which of course is an option in this case, the numbers are halved accordingly.

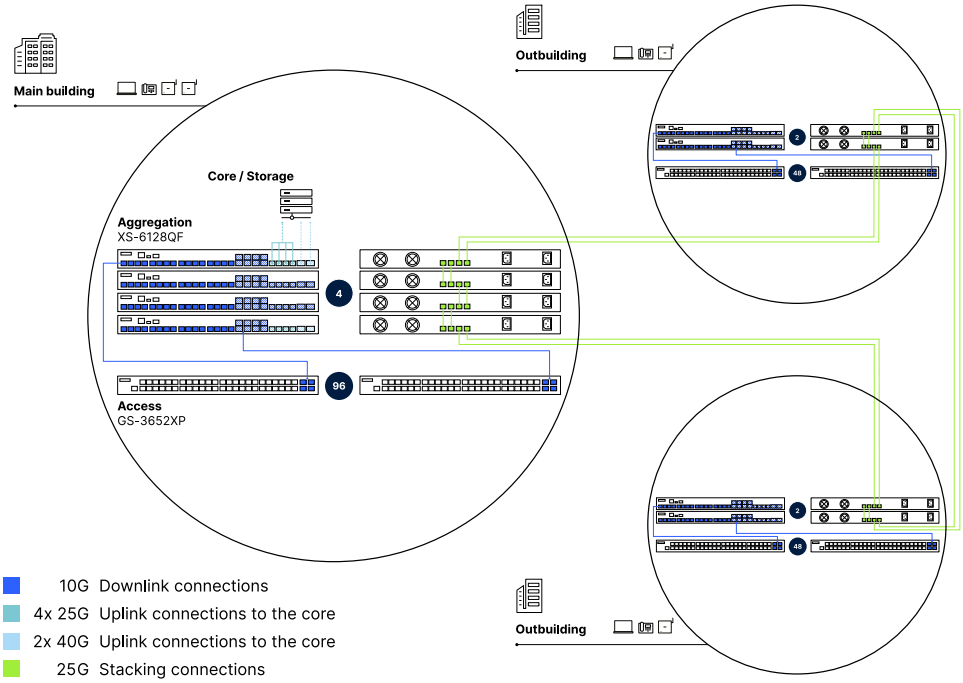

Figure 6:
Example scenario, decentralized stacking

Board types 3 and 4 – no stacking, but with optional uplink

If, in contrast to the previous scenario, the stacking function is not required at all, for example because only a single aggregation switch is operated or it operates as a distribution switch, then the rear-mounted 50G SFP-DD FleX ports are available as additional 25G Ethernet ports. These can be used for four high-performance uplink or downlink connections.

Assuming that we now redundantly network the access switches (2× 10G SFP+ each) with the LANCOM XS-6128QF as a distribution switch, then the 20× 10G SFP+/combo ports and the front-facing 4× 25G SFP28 FleX ports can network up to twelve (24/2) access switches. The uplink to the core layer above uses the rear-mounted 4× 50G SFP-DD FleX ports, which are configured as 4× 25G SFP28 (25G) ports. In total, using the example of the GS-3652XP again results in 12×48, i.e. **576 ports** per distribution switch.

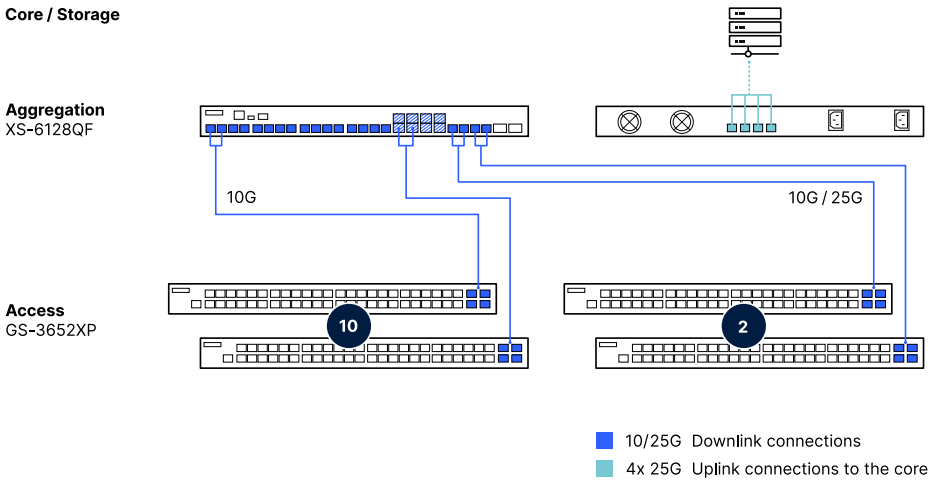

Figure 7:
Example scenario, board type 3 without stacking and without LACP

If there is no redundancy, the number of ports supported on each distribution switch doubles to 24×48, i.e. **1,152 ports**.

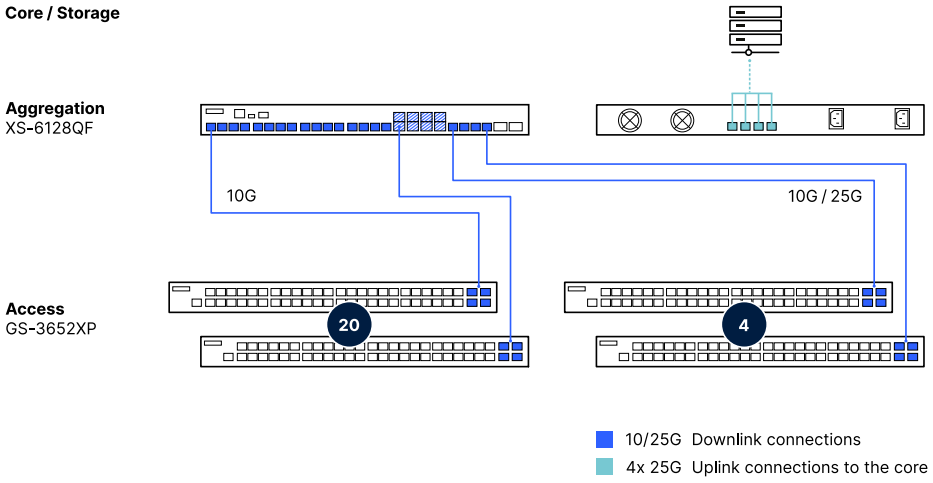

Figure 8:
Example scenario, board type 3 without stacking and with LACP

If the available access switches, such as the LANCOM GS-4500 series, have QSFP+ uplink ports, then operating LACP results in ten plus two additional access switches. This is a total of 12×48, i.e. **576 access ports.**

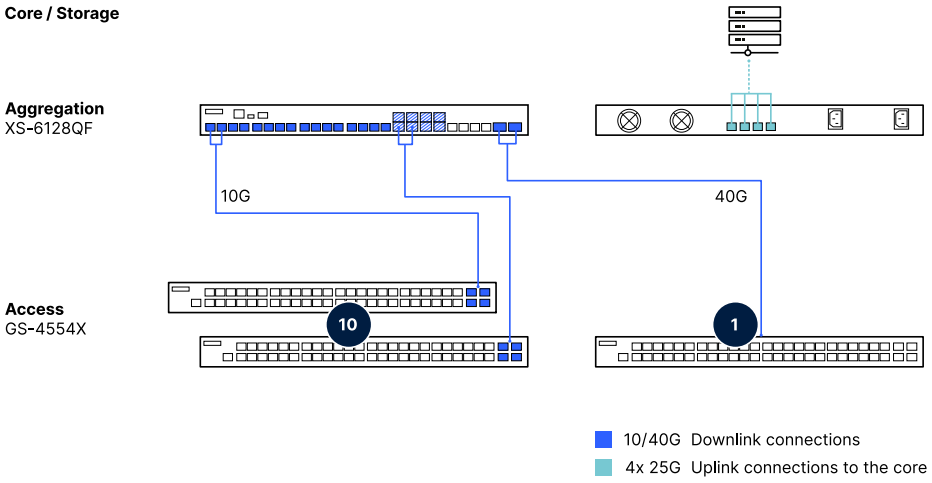

Figure 9:
Example scenario, board type 4 without stacking and with LACP

If there is no redundancy, the number of ports supported on each distribution switch doubles again to 22×48, i.e. **1,056 ports**.

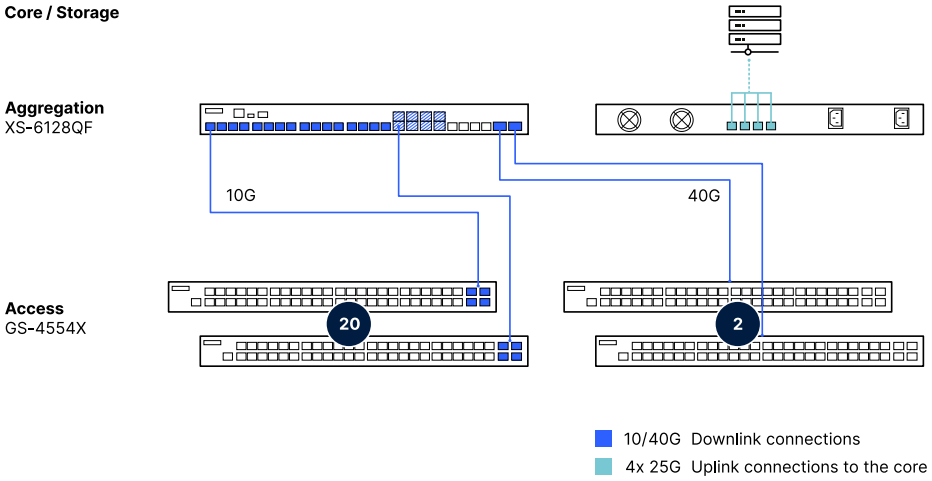

Figure 10:
Example scenario, board type 4 without stacking and without LACP

Board types 3 and 4 – no stacking, no uplink options

If the planned network does not require the uplink at all, the following maximum number of ports results: With 25G SFP28 ports 28×48, i.e. **1,344 access ports**.

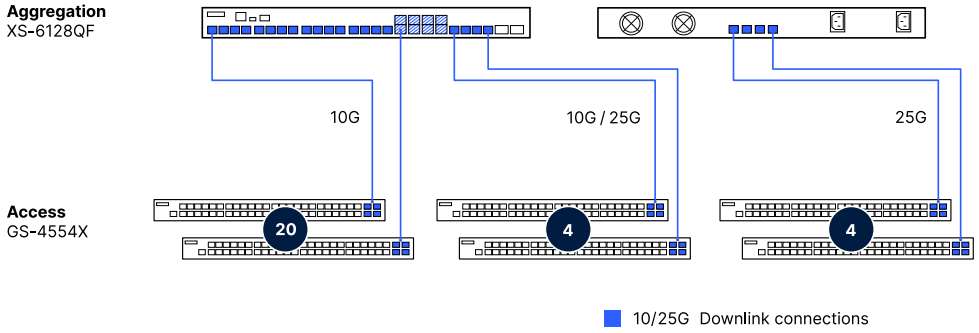

Figure 11:
Example scenario, board type 3 without stacking and without an uplink

With 40G QSFP+ ports, 26×48 results in **1,248 access ports**.

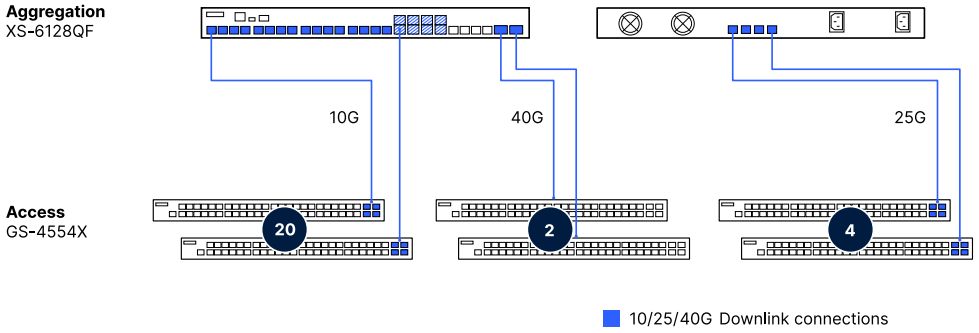

Figure 12:
Example scenario, board type 4 without stacking and without an uplink

Summary

By intelligently combining the various port configurations of the aggregation switch LANCOM XS-6128QF in combination with the high-performance and cost-effective LANCOM access switches, there are almost no limits to the potential applications—in particular for small- and medium-sized enterprises.

In particular when selecting the access switches, which this tech paper mentions only in passing, there are many other parameters to take into account apart from just the number of ports. Also to be taken into account, for example, are the overall PoE budget, the manageability, or the availability of the L3 functionality on the relevant switches.

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