LANCOM Techpaper

LANCOM XS-6128QF configuration options

The growing number of power-hungry end devices and applications is driving the demand for high-performance nodes in multi-tier networks. The LANCOM XS-6128QF is especially designed to operate as an aggregation switch in hierarchical switch infrastructures transporting very high data volumes. With a maximum switch capacity of 1 Terabit, the device operates either as a core switch in two-tier networks or as a distribution switch in three-tier networks. Its idiosyncratic and yet innovative design—characterized by the use exclusively industry-standard interfaces, the availability of all ports without an expensive modular construction, and the use of combo and FleX ports—facilitates the cost-effective implementation of multi-Gigabit infrastructures. This techpaper describes how the innovative design of the LANCOM XS-6128QF helps you to address a wide variety of port and network requirements.

After a look at the basic specifications of the LANCOM XS-6128QF, this techpaper goes on to examine advanced application scenarios and in particular highlights the outstanding versatility of this aggregation switch: Based on four configurable board types, it allows six different port configurations without the need to purchase or exchange expensive modules.

For readers not familiar with technical terms used in this techpaper, we recommend the extensive techpaper "Hierarchical switch infrastructures".

This techpaper in brief

The XS-6128QF offers four board types:

- Board type 1 – 4x SFP28/4x SFP-DD (default)
- Board type 2 – 2x QSFP+/4x SFP-DD
- Board type 3 – 4x SFP28/4x SFP28
- Board type 4 – 2x QSFP+/4x SFP28

The main difference between the board types is how the SFP28 or 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 Systems

LANCOM XS-6128QF specifications

General features of this multi-Gigabit aggregation switch

- 20x SFP+, including 4x multi-Gigabit combo ports (SFP+ or 1G/2.5G/5G/10G nBASE-T), primarily for downlinks
- Optionally 4x SFP28 (10G/25G) or 2x QSFP+ (40G) FleX ports, primarily for uplinks
- Non-blocking backplane stacking via 4x SFP-DD FleX ports (25G/50G)
- Full layer-3 functions including dynamic routing protocols OSPFv2/v3 and BGP4
- Redundant, hot-swappable PSU (second PSU optional)
- 2 hot-swappable fans for maximum reliability
- Front-to-back airflow for optimal cooling in 19" racks
- Security with configurable access control on all ports as per IEEE 802.1X, ACLs
- Secure remote management through TACACS+, SSH, SSL, and SNMPv3
- SD-LAN – for quick and easy configuration via the LANCOM Management Cloud (LMC)
- 5-year warranty on all components, support
- Includes LANCOM SW Lifecycle Management

Port layout

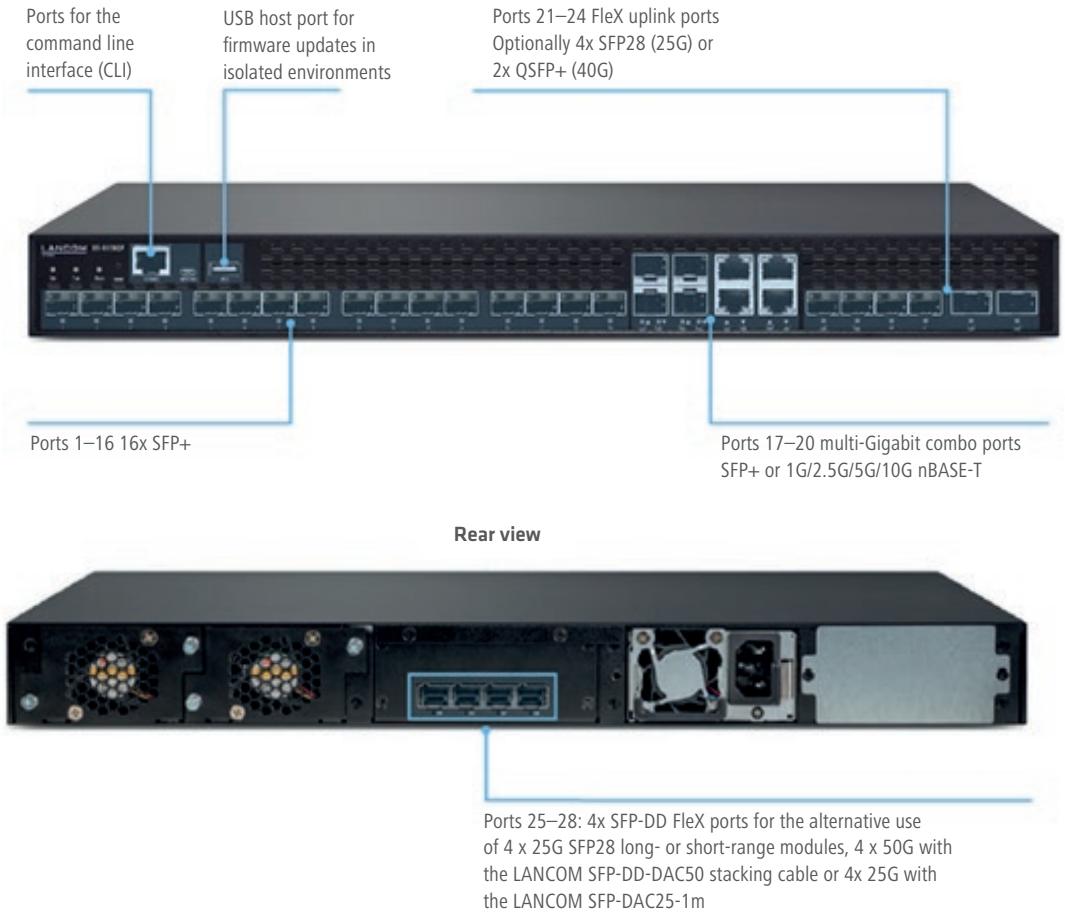

Fig. 1: LANCOM XS-6128QF port layout

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 "Fig. 1: LANCOM XS-6128QF port layout" 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 SFP+ ports or the four 10G nBASE-T ports. The SFP+ ports always take priority here. This means that the switch only activates the 10G copper ports when all four of the associated 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 **4x SFP28 or 2x QSFP+ FleX ports** are primarily intended to be a high-performance uplink to a third switch layer (core or backbone). They allow 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 3-tier network scenario has QSFP+, i.e. 40G connections, the alternative 2x 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 as described in detail below. 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 SFP28 ports do not operate exclusively as 25G links, but optionally as 10G links.

The **four 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 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 SFP-DD FleX ports (which comply with industry standards) are configured as 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. This is an ideal scenario for setting up campus networks.

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 SFP-DD FleX ports when configured as SFP28 ports can alternatively be used as a downlink, i.e. for connecting access switches with 25G uplink ports. Link configuration to 10G is not supported on the 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 (cf. "Configuration changes and combinations in the stack" on page 5). Note that activating any changes to the board type requires a **restart with reboot**.

Board type 1 – 4x SFP28 / 4x SFP-DD (default)
Aggregation switch with 28 ports

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

Board type 2 – 2x QSFP+ / 4x SFP-DD
Aggregation switch with 26 ports

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

Board type 3 – 4x SFP28 / 4x SFP28
Aggregation switch with 28 ports

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

Board type 4 – 2x QSFP+ / 4x SFP28
Aggregation switch with 26 ports

- 16x SFP+ and 4x multi-Gigabit combo ports (SFP+ or 1G/2.5G/5G/10G nBASE-T)
- 2 x QSFP+ ports (40G)
- 4x 25G decentralized stacking via LANCOM SFP-LR-LC25 or SFP-SR-LC25 or use as 4x SFP28 25G 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 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			
		SFP+ (combo)	SFP28	QSFP+	SFP-DD				
Option	Board type	Port bandwidth used				10G	25G	40G	50G
1	1	20 x 10G	4 x 25G	–	4 x 50G	20	4	–	4
2	1	20 x 10G	4 x 10G*	–	4 x 50G	24	–	–	4
3	2	20 x 10G	–	2 x 40G	4 x 50G	20	–	2	4
4	3	20 x 10G	4 x 25G	–	4 x 25G**	20	8	–	–
5	3	20 x 10G	4 x 10G*	–	4 x 25G**	24	4	–	–
6	4	20 x 10G	–	2 x 40G	4 x 25G**	20	4	2	–

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

Tab. 1: Board types overview

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 QSFP+ ports at the front are not activated in favor of the four SFP28 ports at 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.

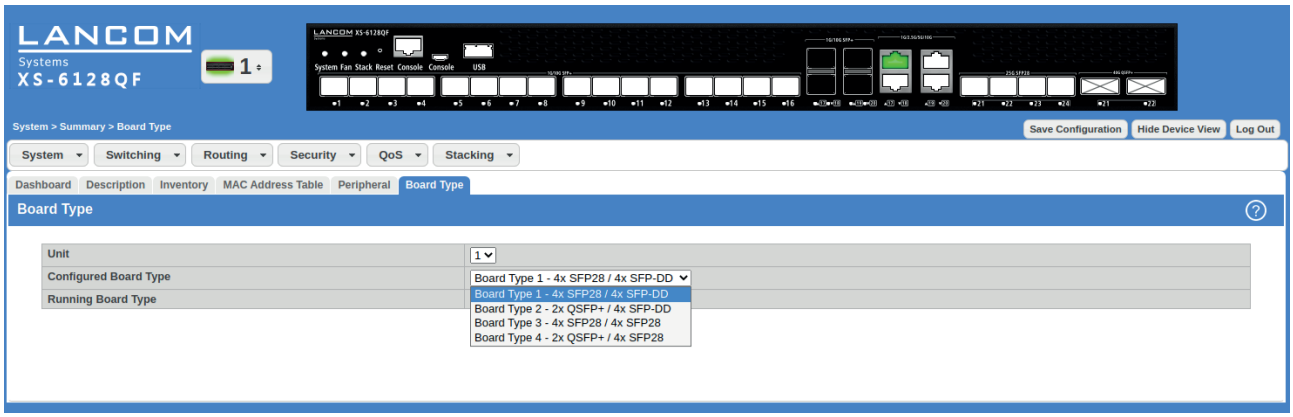

Fig. 2: WebGUI selection menu for board types

If you plan to or already operate a stack, the "Unit" selection field shown in figure 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 are possible within a stack:

- Combined operation of "**Board type 1** – 4x SFP28 / 4x SFP-DD" with "**Board type 2** – 2x QSFP+ / 4x SFP-DD"
- Combined operation of "**Board type 3** – 4x SFP28 / 4x SFP28" with "**Board type 4** – 2x QSFP+ / 4x 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". See "Fig. 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 large 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 4x SFP-DD (50G) FleX 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 4x SFP28 (25G) 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 20x 10G downlink ports for the aggregation of access switches. In a stack of eight, this corresponds to 8x20 or 160 10G downlink ports.

If you also add the free 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 6x4, 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-3152X access switch, which provides 48 1G ports, this results in networks with 184x48 or 8,832 ports. See also "Fig. 4: Example scenario, board type 1+2 without redundancy".

```
(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
```

Fig. 3: Board-type CLI commands

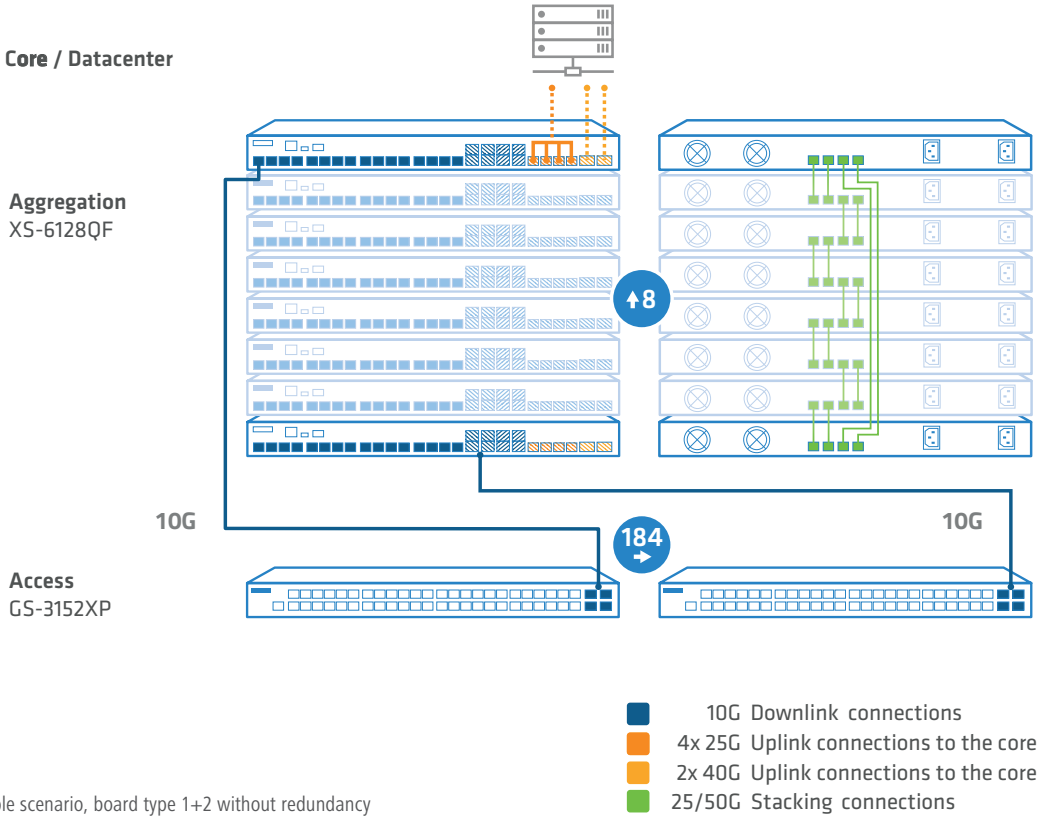

Fig. 4: Example scenario, board type 1+2 without redundancy

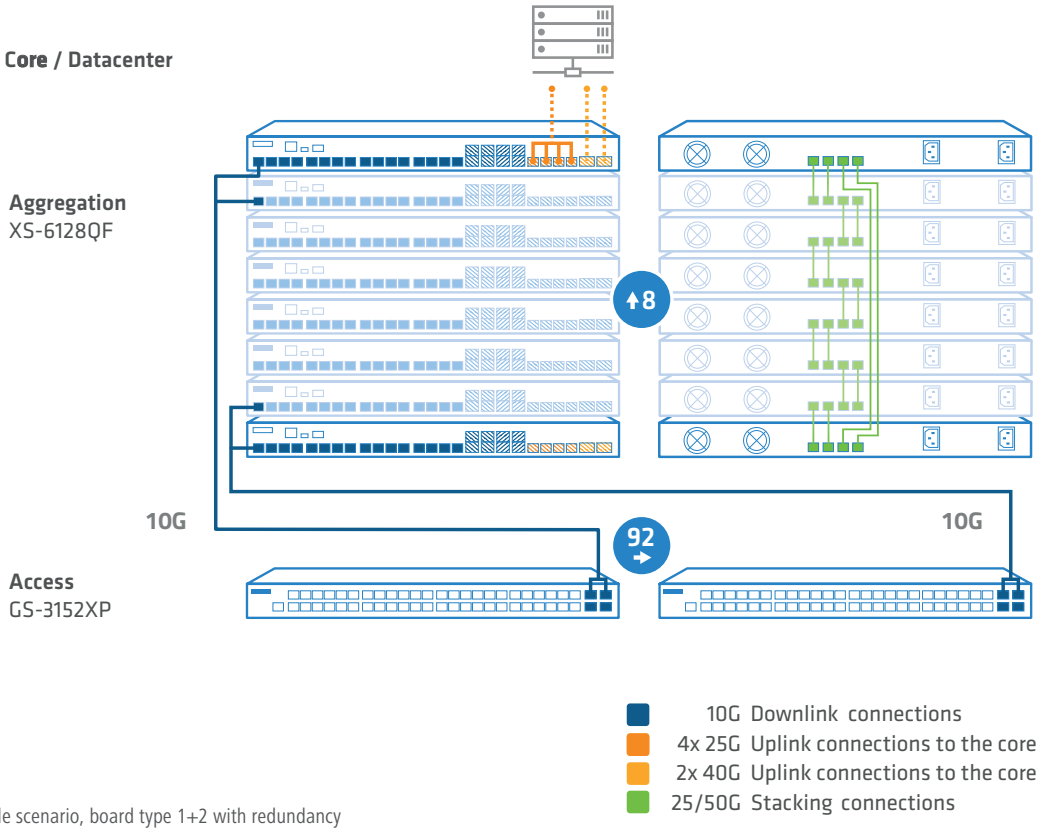

Fig. 5: Example scenario, board type 1+2 with redundancy

In redundancy scenarios, where each access switch is connected to the aggregation layer by two 10G ports, this allows for networks with 184x48/2, 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. See also "Fig. 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 large campus 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 SFP-DD FleX ports as SFP28 ports and which support the use of single- or multi-mode SFP28 transceivers. Since 50G-SFP-DD transceivers are currently not very widespread on the market and this technology is still very expensive, the 25G transceivers can be used cost-effectively and without problem. 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. "Fig. 6: Example scenario decentralized stacking" shows such an example for decentralized stacking. In addition to a main building, the stack is distributed over two further outbuildings. In this example, the main building has 96 access switches, which results in 4,608 access ports when the GS-3152XP is used again. In the outbuildings, this results in 48 access switches with 2,304 ports. With redundant cabling of access switches to the aggregation level, which is of course just as possible here, the figures are halved accordingly.

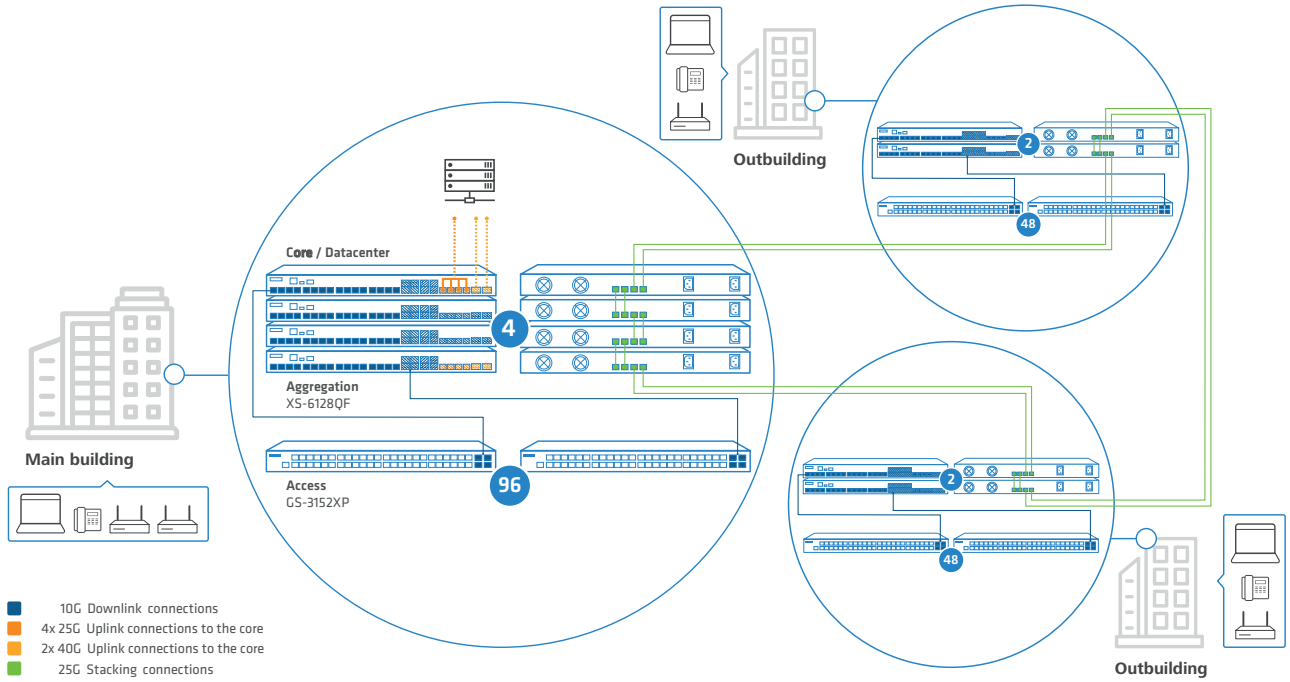

Fig. 6: Example scenario decentralized stacking

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

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 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 (2x SFP+ each) with the LANCOM XS-6128QF as a distribution switch, then the 20x 10G SFP+/combo ports and the front-facing 4x SFP28 FleX ports can network up to twelve (24/2) access switches. The uplink to the core layer above uses the rear-mounted 4x SFP-DD FleX ports, which are configured as 4x SFP28 (25G) ports. In total, using the example of the GS-3152XP again results in 12x48, i.e. 576 ports per distribution switch. See also "Fig. 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 24x48, i.e. 1,152 ports. See "Fig. 8: Example scenario, board type 3 without stacking and with LACP".

If the existing access switches have QSFP+ uplink ports, then operating LACP results in ten plus one additional access switches. This is a total of 11x48, i.e. 528 access ports. See "Fig. 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 22x48, i.e. 1,056 ports. See "Fig. 10: Example scenario, board type 3 without stacking and without LACP".

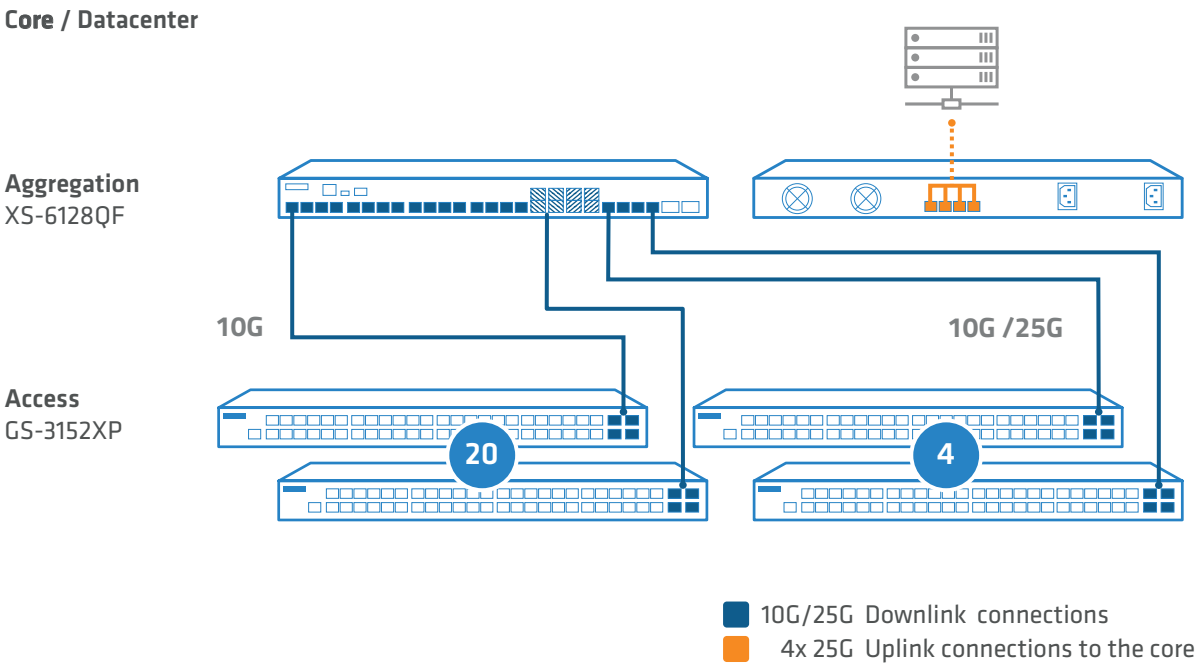

Fig. 7: Example scenario, board type 3 without stacking and without LACP

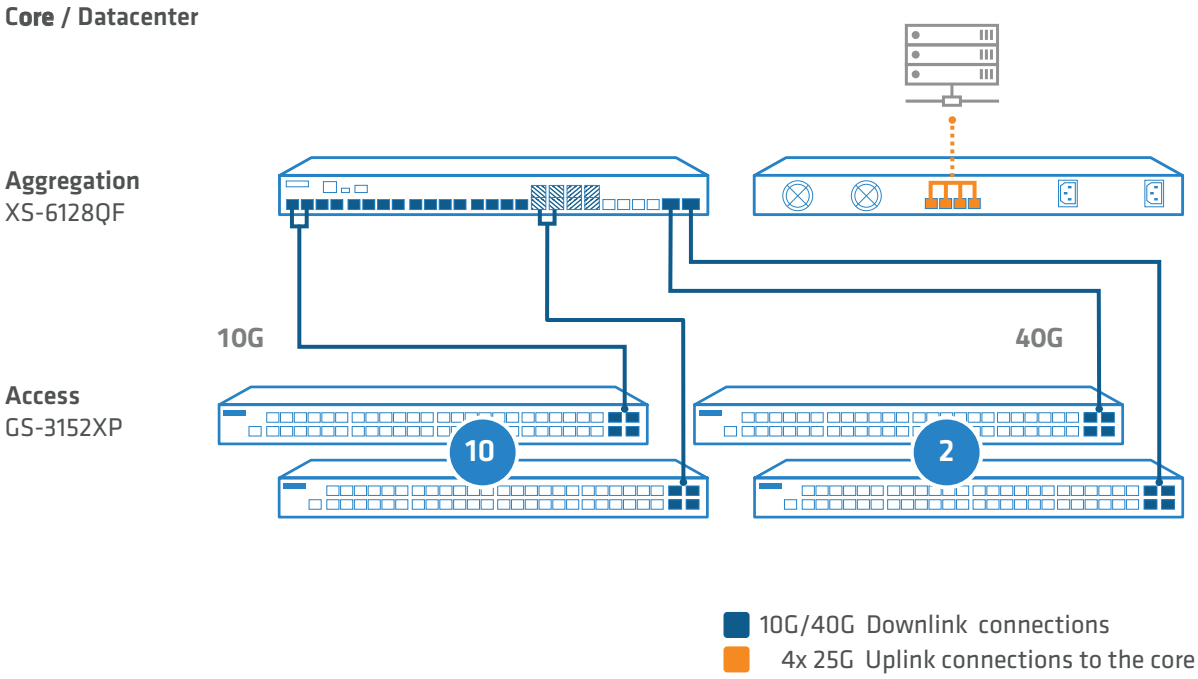

Fig. 8: Example scenario, board type 3 without stacking and with LACP

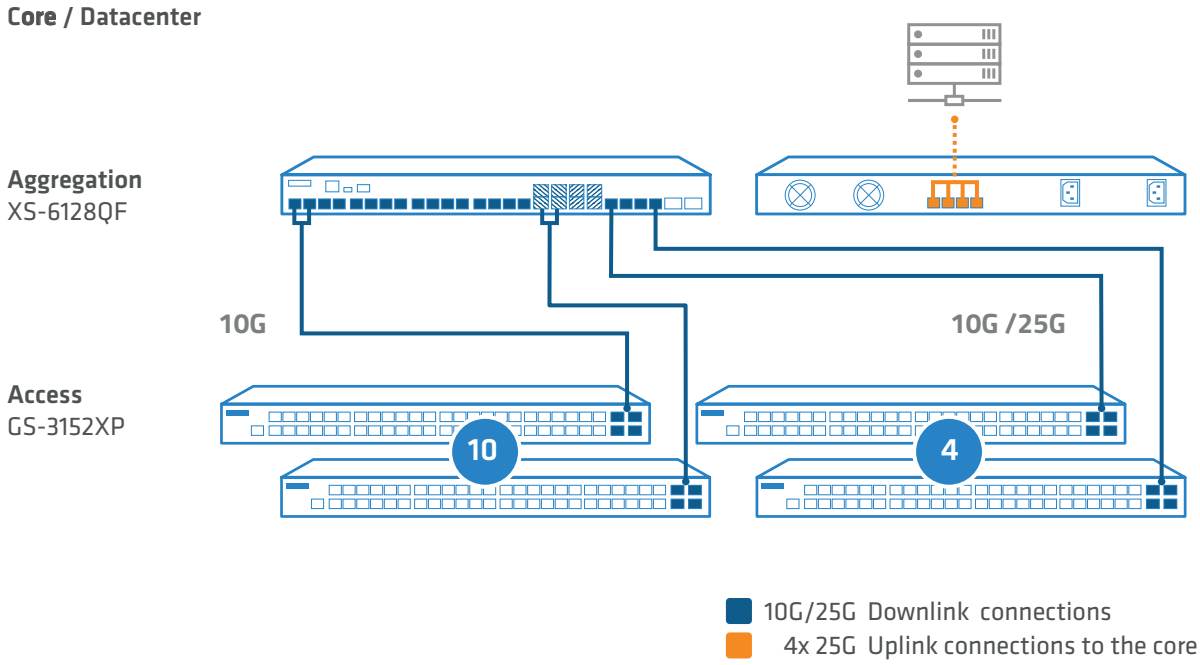

Fig. 9: Example scenario, board type 4 without stacking and with LACP

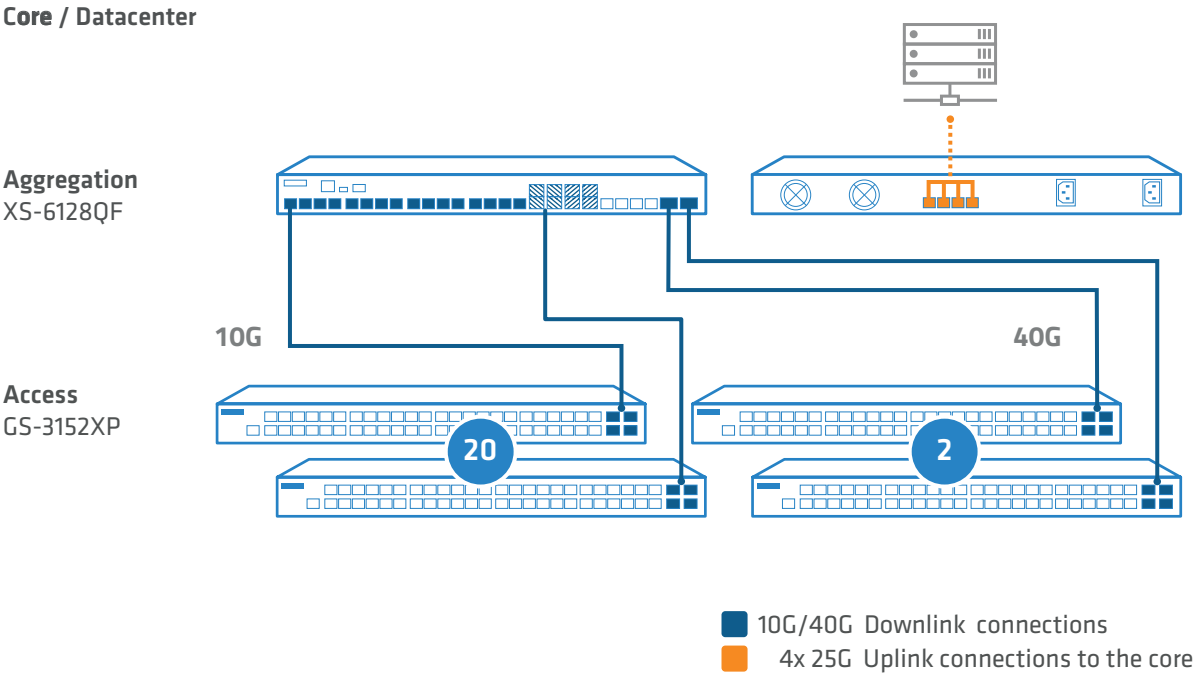

Fig. 10: Example scenario, board type 3 without stacking and without LACP

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 SFP28 ports 28x48, i.e. 1,344 access ports. See "Fig. 11: Example scenario, board type 3 without stacking and without an uplink".

With QSFP+ ports 26x48, i.e. 1,248 access ports. See "Fig. 12: Example scenario, board type 4 without stacking and without an uplink".

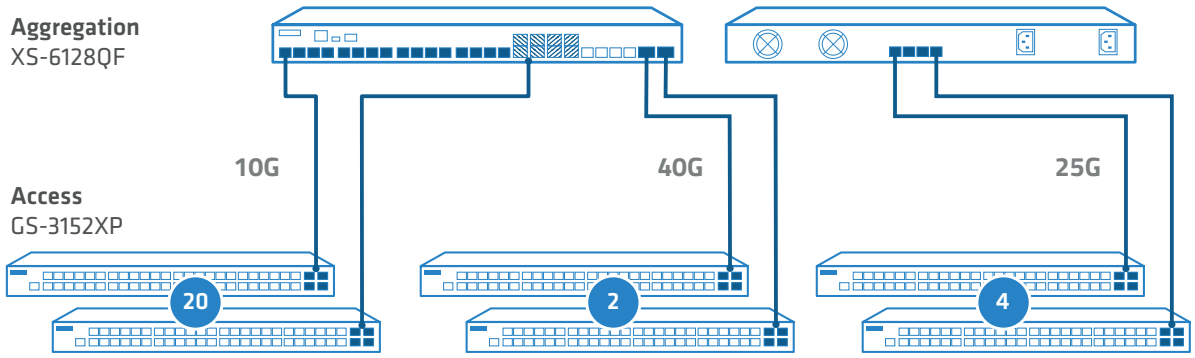

Fig. 11: Example scenario, board type 3 without stacking and without an uplink

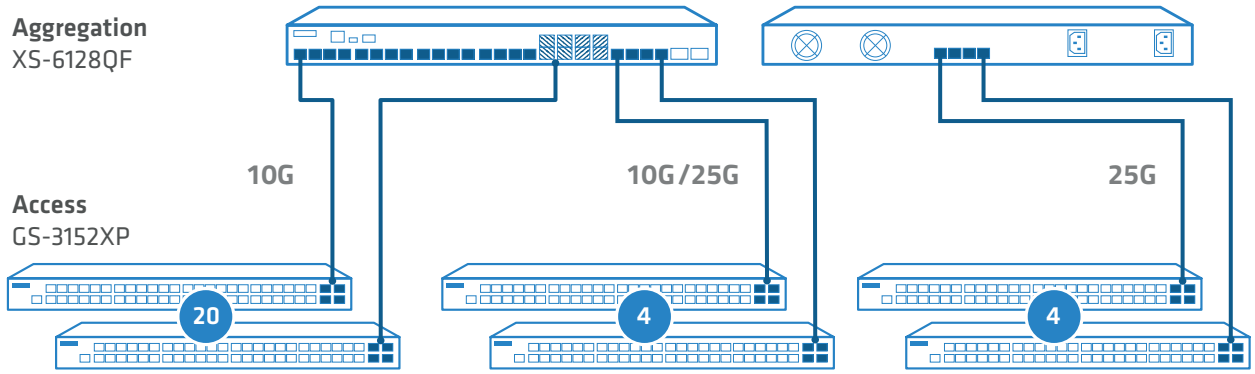

Fig. 12: Example scenario, board type 4 without stacking and without an uplink

Summary

By intelligently combining the various port configurations of the LANCOM XS-6128QF with the high-performance and cost-effective access switches from LANCOM, 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 techpaper 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.

LANCOM Systems is the competent manufacturer at your side. Experienced LANCOM technicians and the specialists from our system-vendor partners will help you with the planning and installation of a needs-based and future-proof LANCOM network.