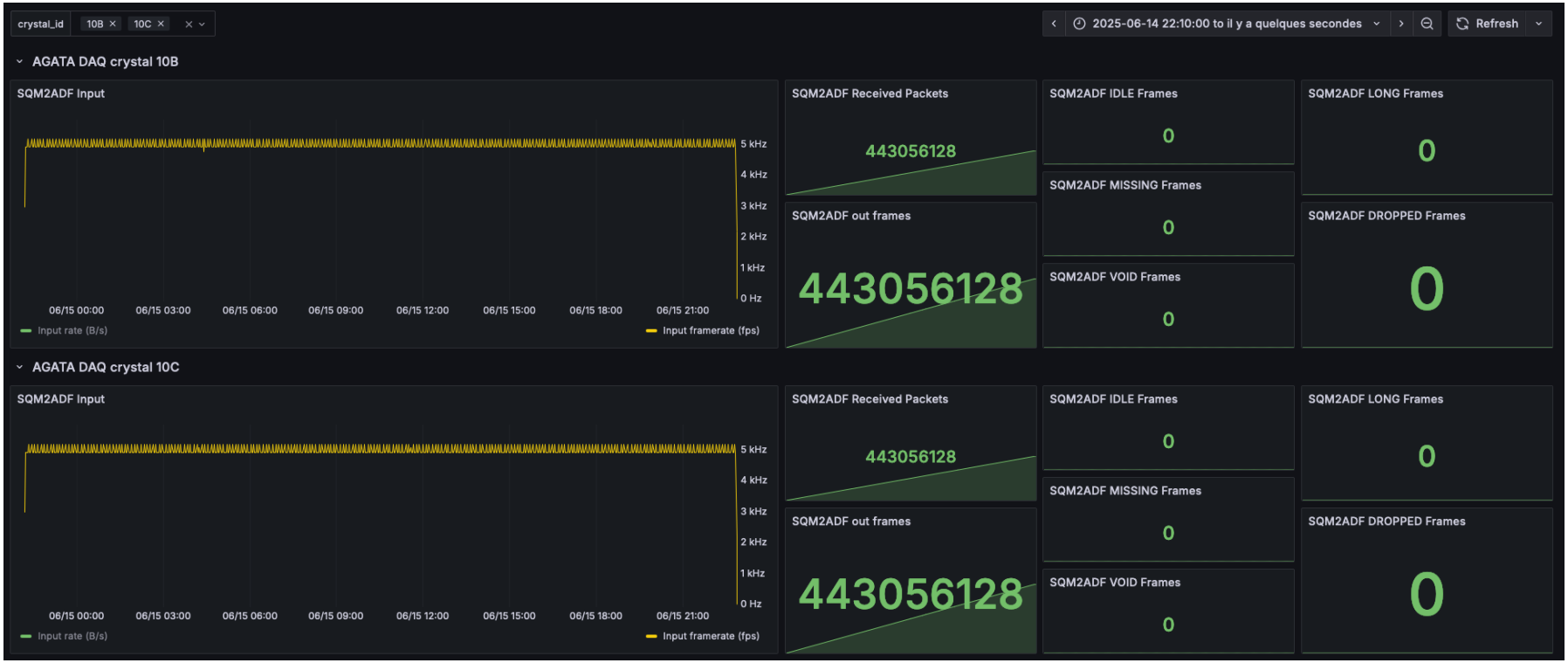
V2 Electronics – DAQ and Processing tests



Hardware & Software
Dataflow
Tests results

G. Baulieu, N. Dosme, S. Elloumi, X. Lafay
and the AGATA Data Processing Group

Available Hardware and Software

- **C6400 servers** :
  - Used for development for several years
  - Debian 10 (too old for production)
  - Not final Hardware (will not go to Legnaro)

Available Hardware and Software

- **C6400 servers** :
  - Used for development for several years
  - Debian 10 (too old for production)
  - Not final Hardware (will not go to Legnaro)

- **Snode020-033 servers** :
  - Purchased in 2024
  - Debian 12 with new DCOD version (05/2025)
  - Will go to Legnaro to be used in production

Available Hardware and Software

- **C6400 servers** :
  - Used for development for several years
  - Debian 10 (too old for production)
  - Not final Hardware (will not go to Legnaro)

- **Snode020-033 servers** :
  - Purchased in 2024
  - Debian 12 with new DCOD version (05/2025)
  - Will go to Legnaro to be used in production

- **STARE cards** :
  - Real datasources for production
  - Data from firmware emulator (loop on 1 event in memory)

Available Hardware and Software

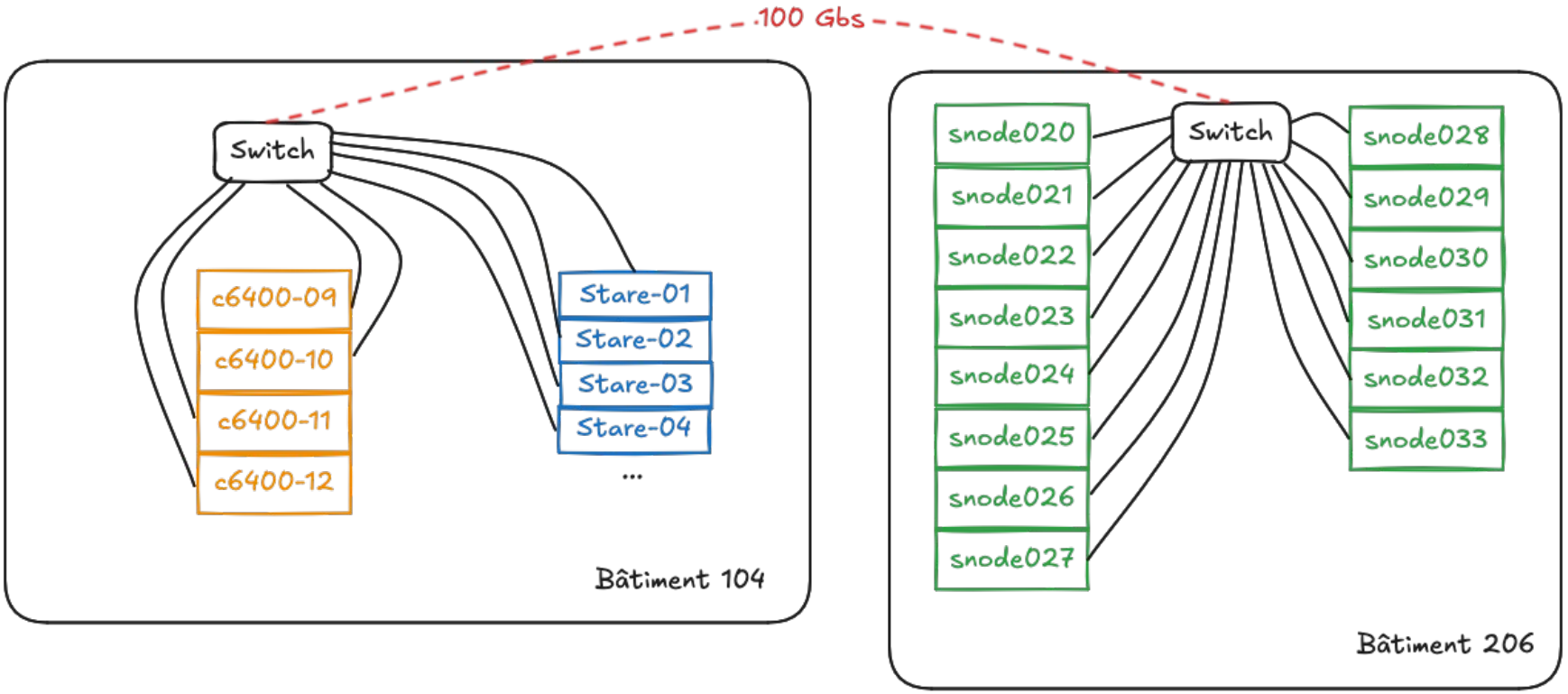
- **C6400 servers** :
  - Used for development for several years
  - Debian 10 (too old for production)
  - Not final Hardware (will not go to Legnaro)

- **Snode020-033 servers** :
  - Purchased in 2024
  - Debian 12 with new DCOD version (05/2025)
  - Will go to Legnaro to be used in production

- **STARE cards** :
  - Real datasources for production
  - Data from firmware emulator (loop on 1 event in memory)

- **Software Emulator (ADF2UDPServer)** :
  - Send data using STARE format
  - Can load any ADF file
  - Loop over hundreds of thousands of events
  - Different packets timeline from STARE card

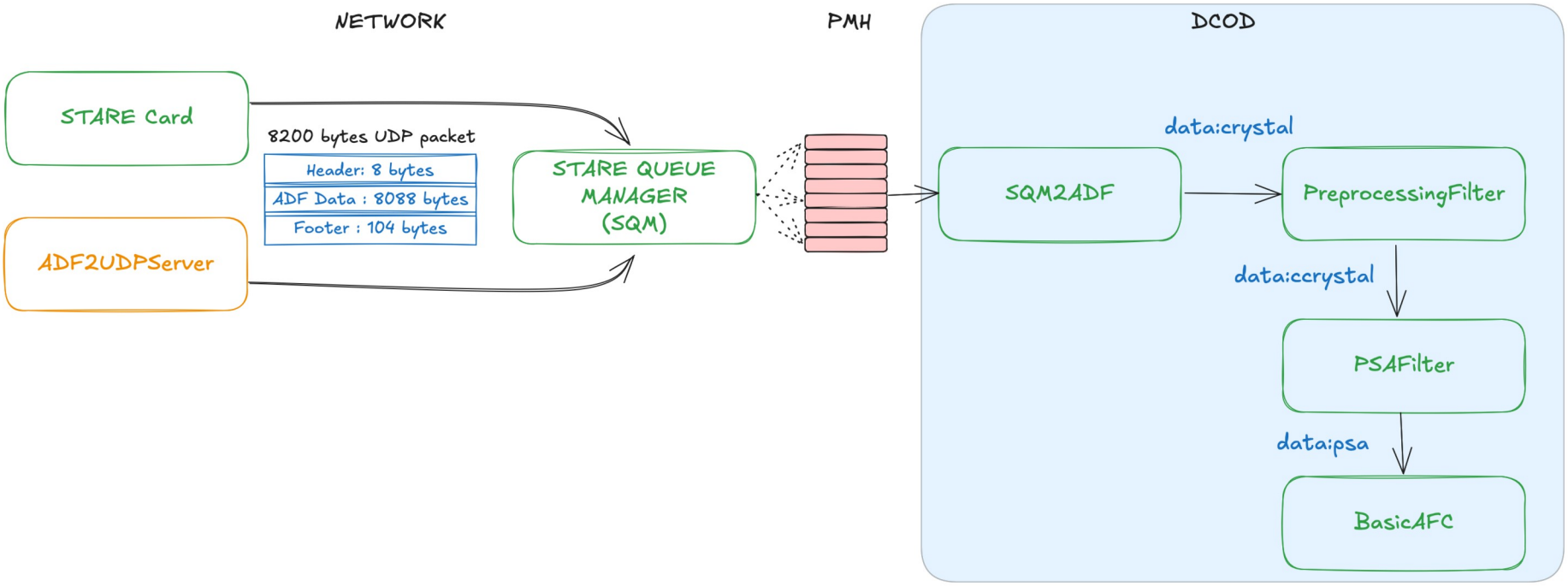
Hardware location



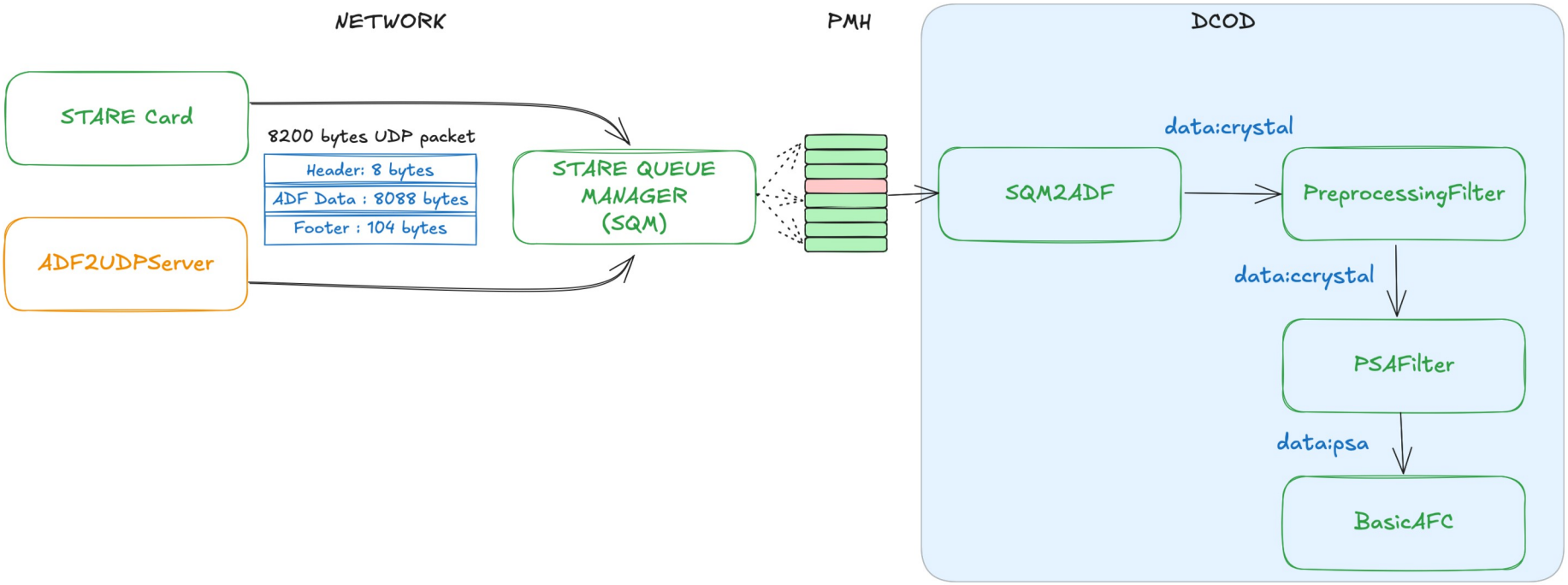
100 Gb/s link ordered but not yet received : currently no connection between 2 buildings : can NOT send data from STARE cards to snode*

→ Tests on snode* will use the Software Emulator

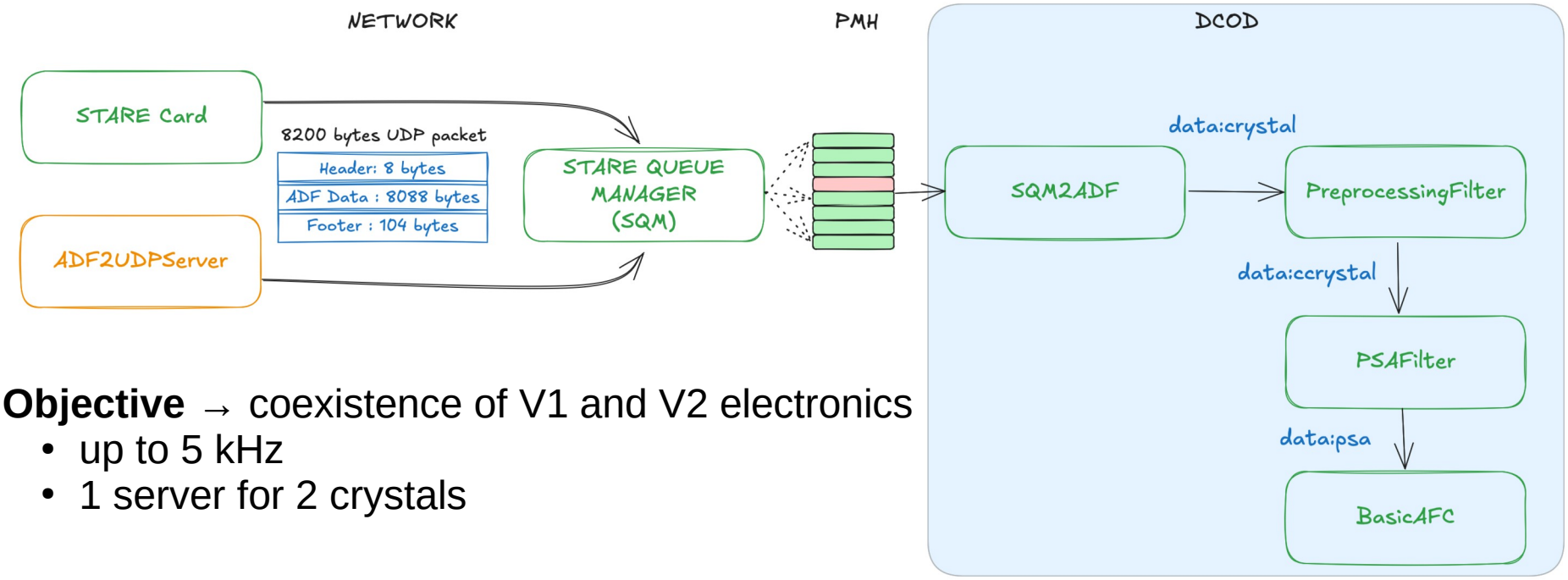
Dataflow


NETWORK
PMH
DCOD
STARE Card
ADF2UDPServer
8200 bytes UDP packet
Header: 8 bytes
ADF Data : 8088 bytes
Footer : 104 bytes
STARE QUEUE MANAGER (SQM)
data:crystal
SQM2ADF
PreprocessingFilter
data:ccrystal
PSAFilter
data:psa
BasicAFC

Dataflow


NETWORK
PMH
DCOD
STARE Card
ADF2UDPServer
8200 bytes UDP packet
Header: 8 bytes
ADF Data : 8088 bytes
Footer : 104 bytes
STARE QUEUE MANAGER (SQM)
data:crystal
SQM2ADF
PreprocessingFilter
data:ccrystal
PSAFilter
data:psa
BasicAFC

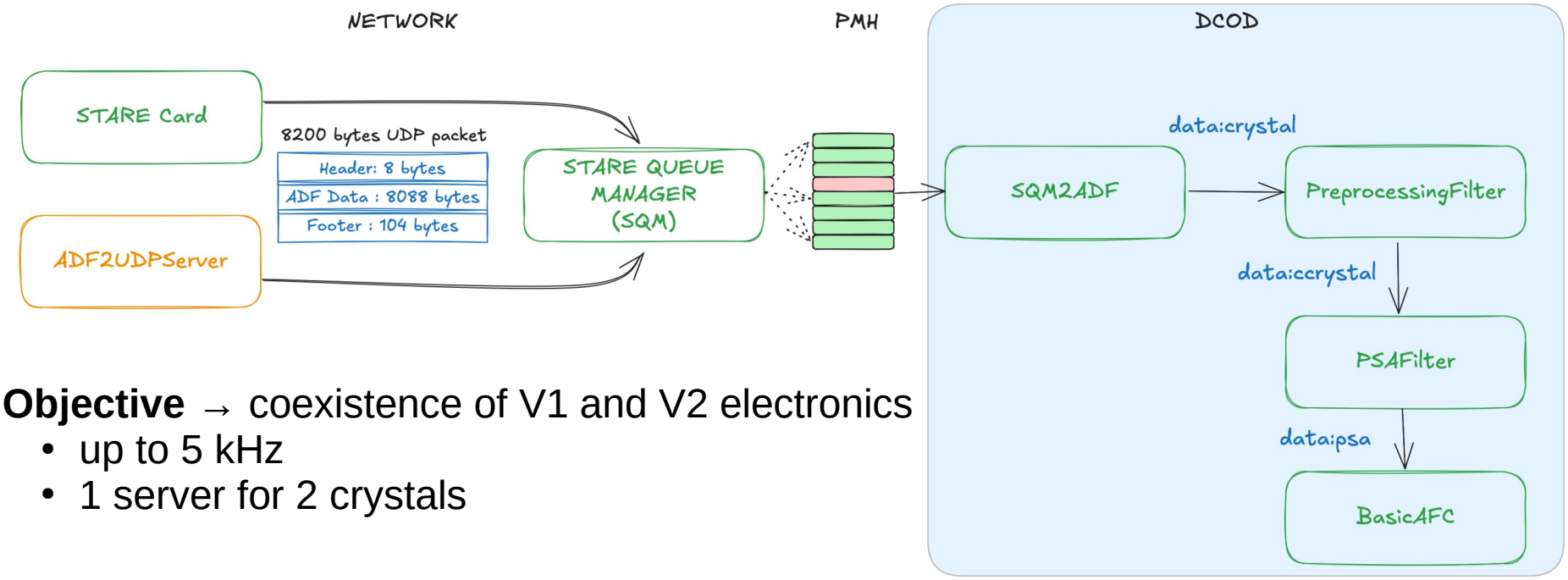
Dataflow



Objective → coexistence of V1 and V2 electronics

- up to 5 kHz
- 1 server for 2 crystals

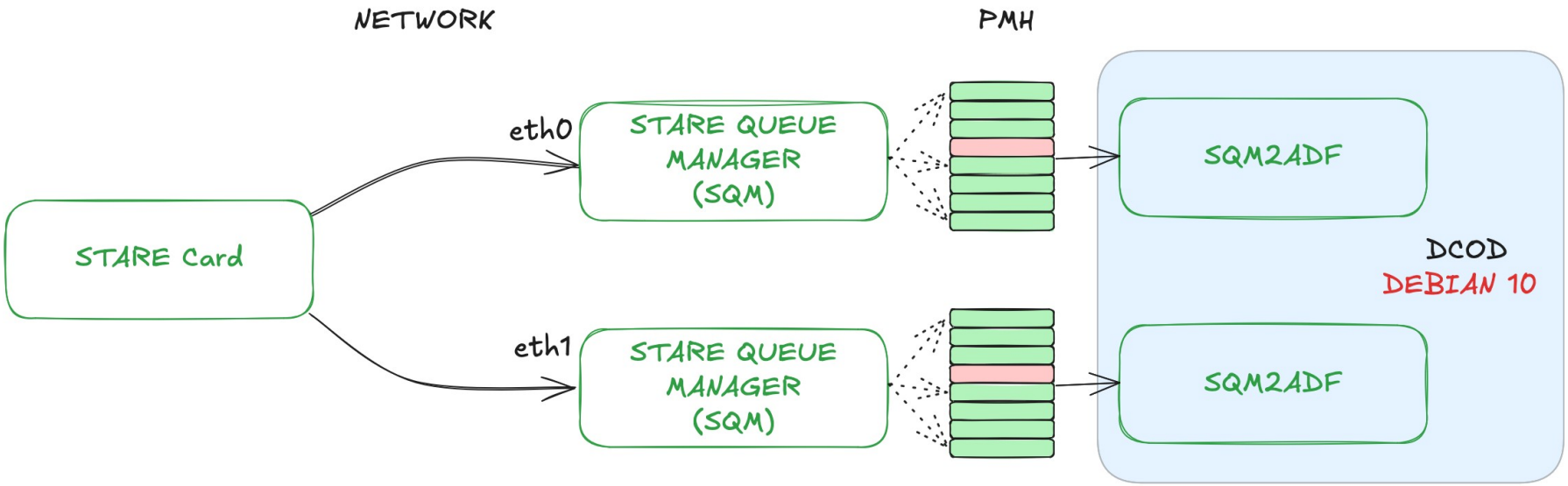
Dataflow



Objective → coexistence of V1 and V2 electronics
- up to 5 kHz
- 1 server for 2 crystals

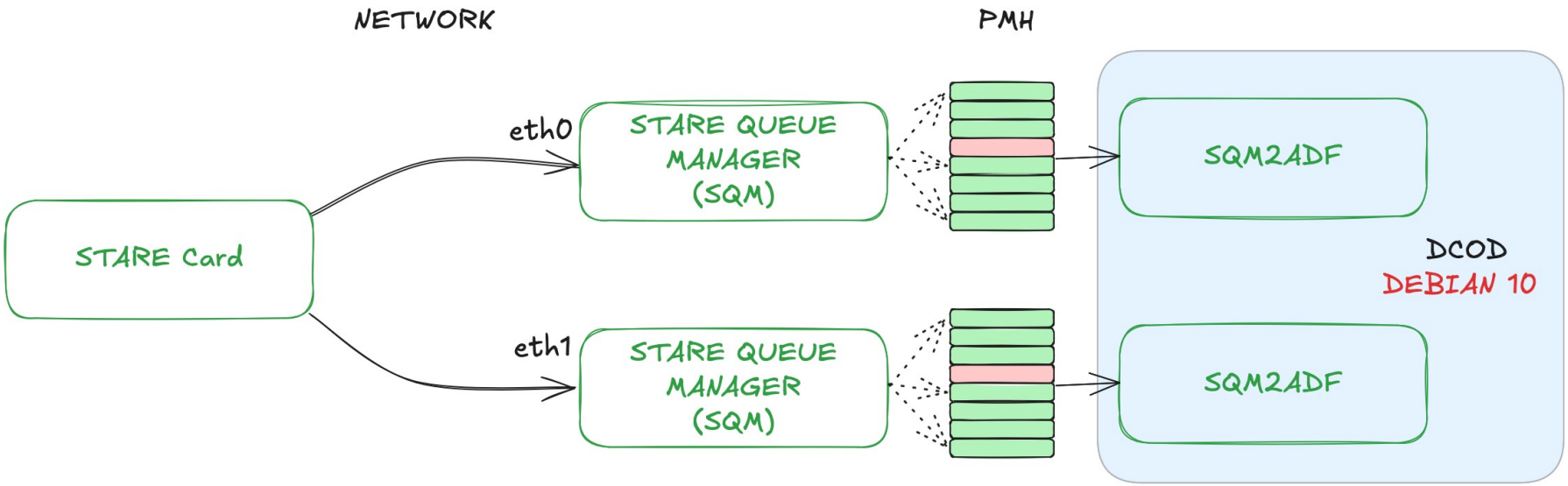
Risk → UDP protocol does NOT ensure packets reception
- No way of retrieving packet if lost
- Packet loss may happen at different places : NIC, switch, OS Kernel…
- We can only reduce the probability of packets loss

STARE card to SQM2ADF



2 different ADF frames loaded on each emulator

STARE card to SQM2ADF



2 different ADF frames loaded on each emulator

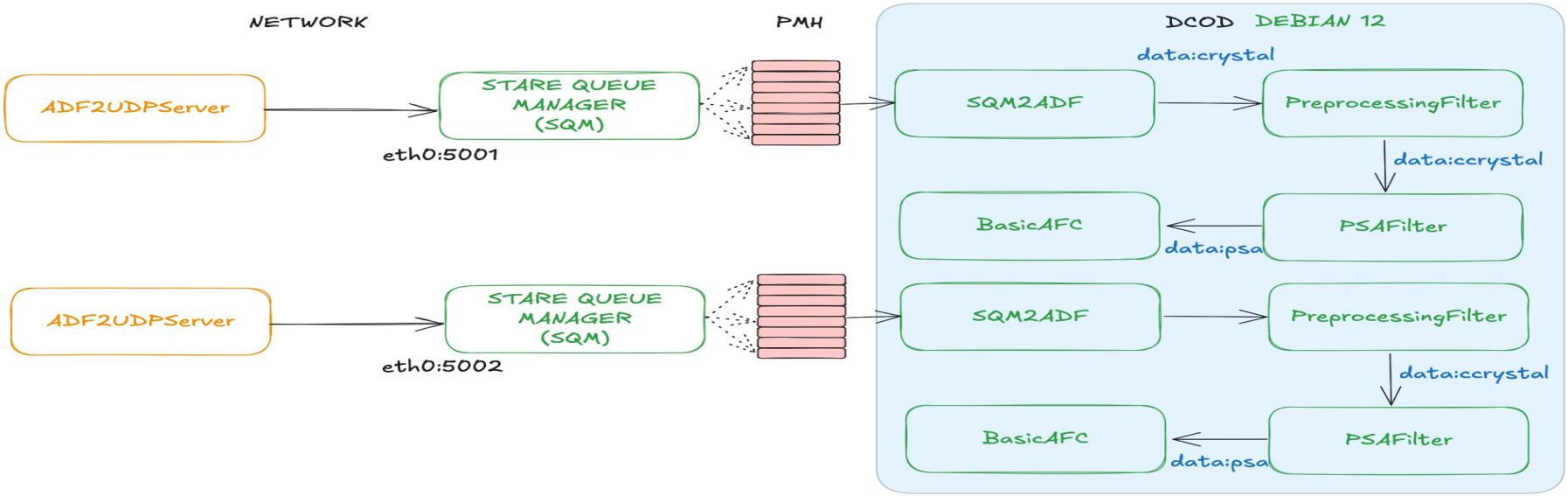
18H @5kHz :

- 323.780.608 packets sent on each interface
- Respectively **234 and 0 packets lost**

7H45 @15kHz :

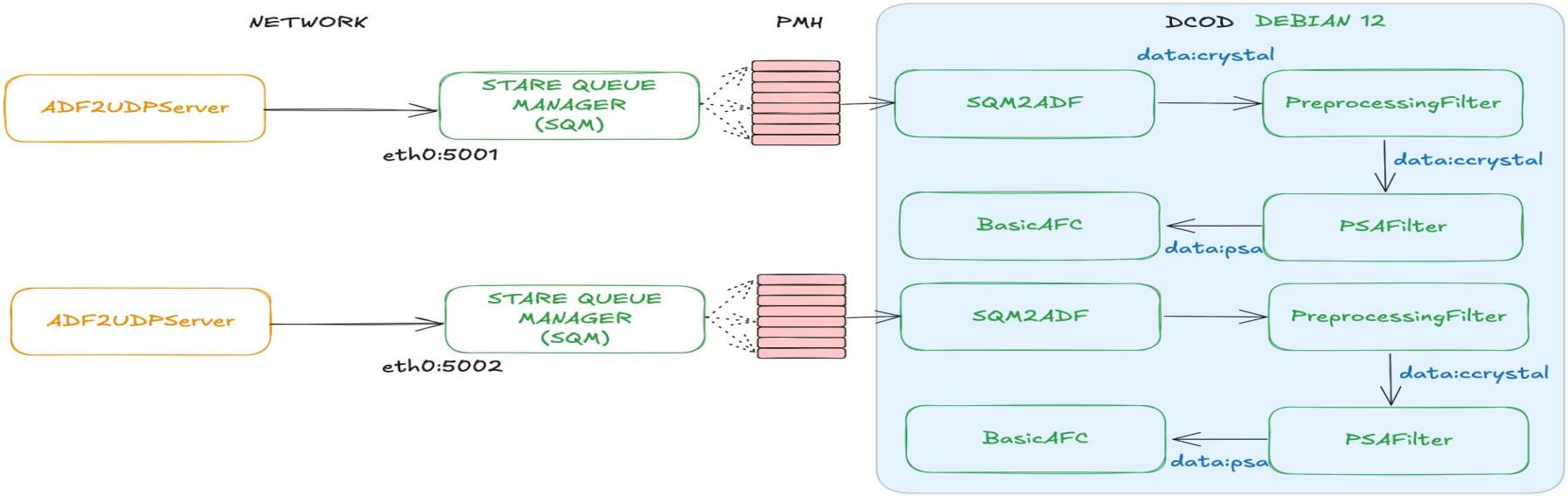
- 419.397.632 packets sent on each interface
- **No packet loss**

2 x Soft Emulator → Full Chain



[After incremental updates of configuration on reception server (Kernel+NIC)]

2 x Soft Emulator → Full Chain

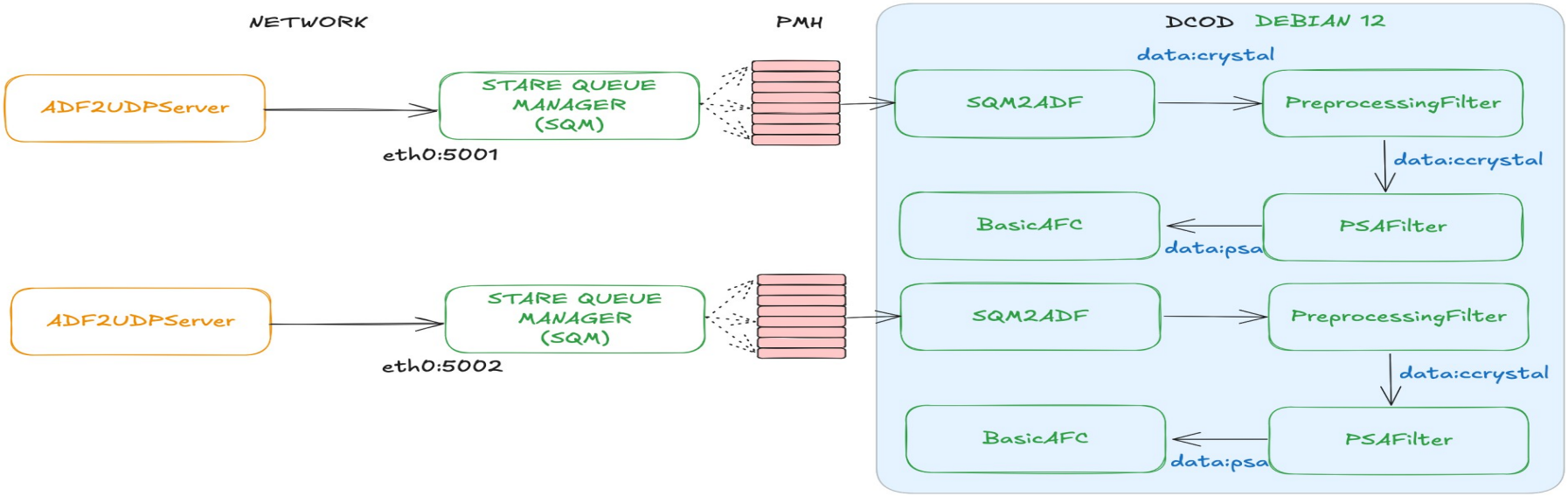


[After incremental updates of configuration on reception server (Kernel+NIC)]

24H @5kHz :

- 443.056.128 packets sent on each interface
- **Both chains show no packet loss**

2 x Soft Emulator → Full Chain



[After incremental updates of configuration on reception server (Kernel+NIC)]

24H @5kHz :

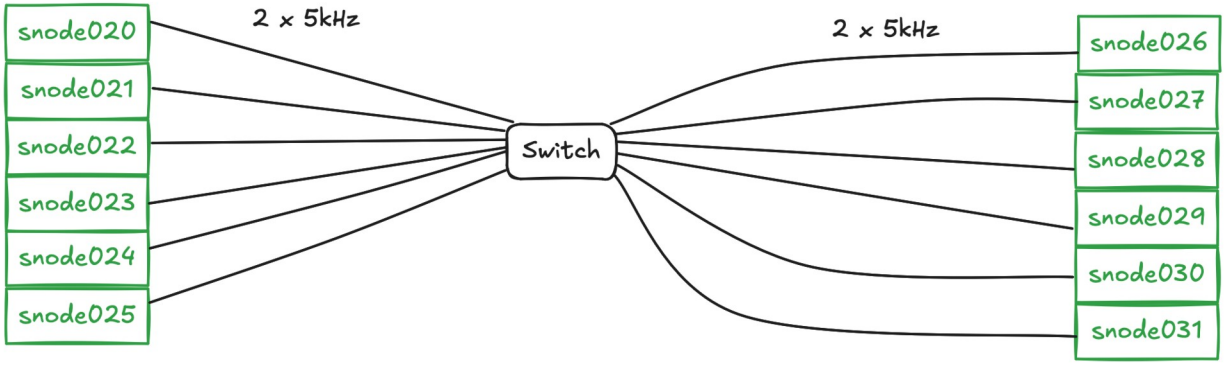
- 443.056.128 packets sent on each interface
- **Both chains show no packet loss**

Stopping 1 chain (1 server for 1 crystal) :

- 22H @ 10kHz : no packet loss
- + 8h30 @ 12kHz : no packet loss
- + 1h30 @ 14kHz : no packet loss … PSA back pressure @15kHz

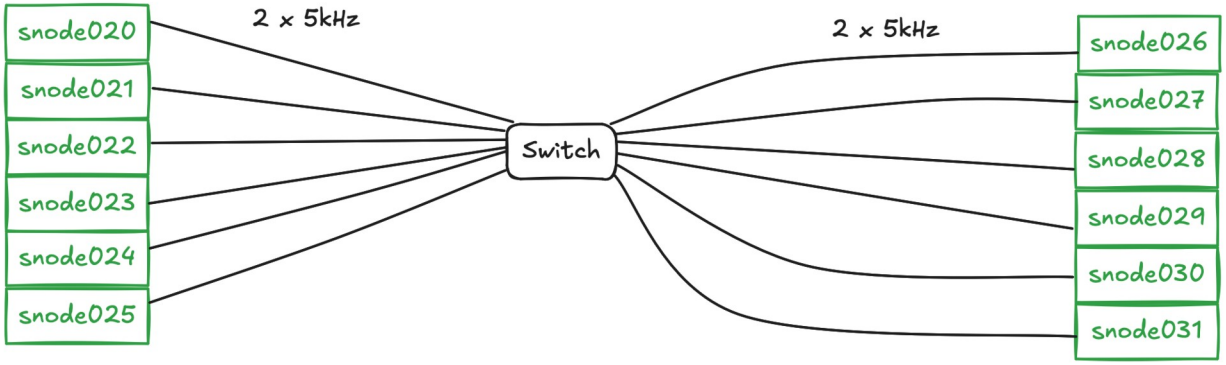
Loading the network :

12 x Soft Emulators on 6 servers → 12 x Full Chains on 6 servers



Loading the network :

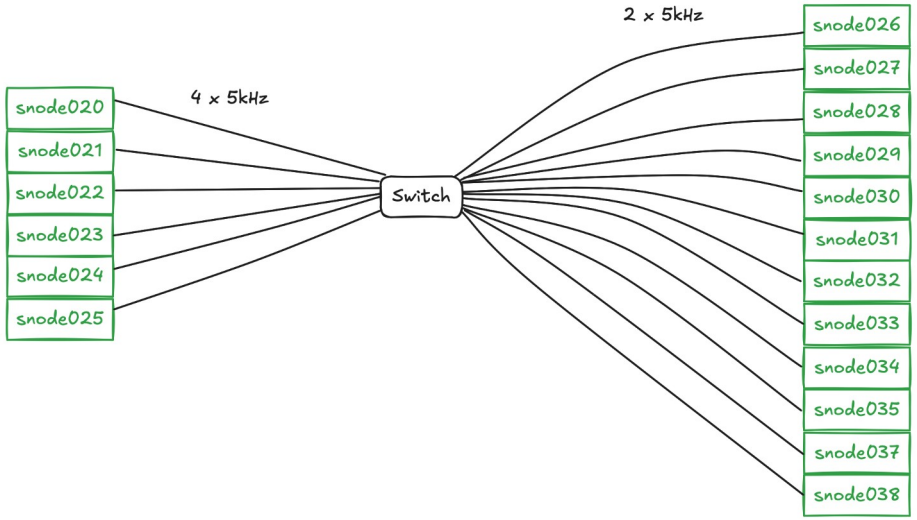
12 x Soft Emulators on 6 servers → 12 x Full Chains on 6 servers



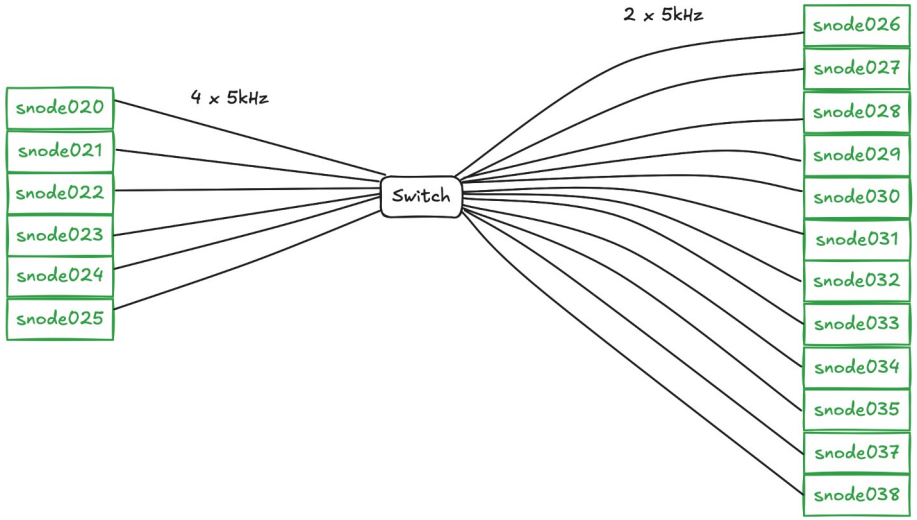
24H30 @5kHz :

- 442.073.088 packets sent on each chain
- **447, 425 and 1** packets lost on 3 chains (2 first from same source computer)
- 9 chains with **no packet loss**

Ramping up : 24 x Soft Emulators on 6 servers → 24 x Full Chains on 12 servers



Ramping up : 24 x Soft Emulators on 6 servers → 24 x Full Chains on 12 servers



15H @5kHz :

- Crash on 05A chain under investigation
- Significant packets loss (up to 0.03%)
- Loss rate seems correlated to sending server
  → 4 emulators on 1 interface would be too much?

… need to investigate at switch level and reproduce the test with 12 STARE cards + 12 Soft emulators

	Crystal	Packets loss
	00A	0
snode020	03A	0
	05A	
	06A	0
	04A	26624
snode021	10A	18688
	12A	49408
	14A	72128
	00B	2752
snode022	05B	8704
	06B	0
	12B	21312
	03B	448
snode023	04B	0
	10B	640
	14B	1728
	00C	23315
snode024	04C	3264
	05C	1728
	06C	6656
	10C	0
snode025	03C	0
	12C	0
	14C	0

Conclusions

- After first tests, a well configured snode server seems able to manage 2 x 5kHz full processing chains with acceptable UDP packets loss.

Conclusions

- After first tests, a well configured snode server seems able to manage 2 x 5kHz full processing chains with acceptable UDP packets loss.

- Adapting the server kernel and NIC buffers size is mandatory

Conclusions

- After first tests, a well configured snode server seems able to manage 2 x 5kHz full processing chains with acceptable UDP packets loss.
- Adapting the server kernel and NIC buffers size is mandatory
- Need to study possible UDP packets loss at switch level and adapt configuration

Conclusions

- After first tests, a well configured snode server seems able to manage 2 x 5kHz full processing chains with acceptable UDP packets loss.
- Adapting the server kernel and NIC buffers size is mandatory
- Need to study possible UDP packets loss at switch level and adapt configuration
- Waiting for 100 Gb/s link between buildings 104 and 206 to start tests from Stare cards to snode servers :
  - 12 full chains from stare cards
  - 12 full chains from stare cards + 12 full chains from soft emulator