The revival of the learning-sync bridgeport flag

HiperSockets Converged Interface

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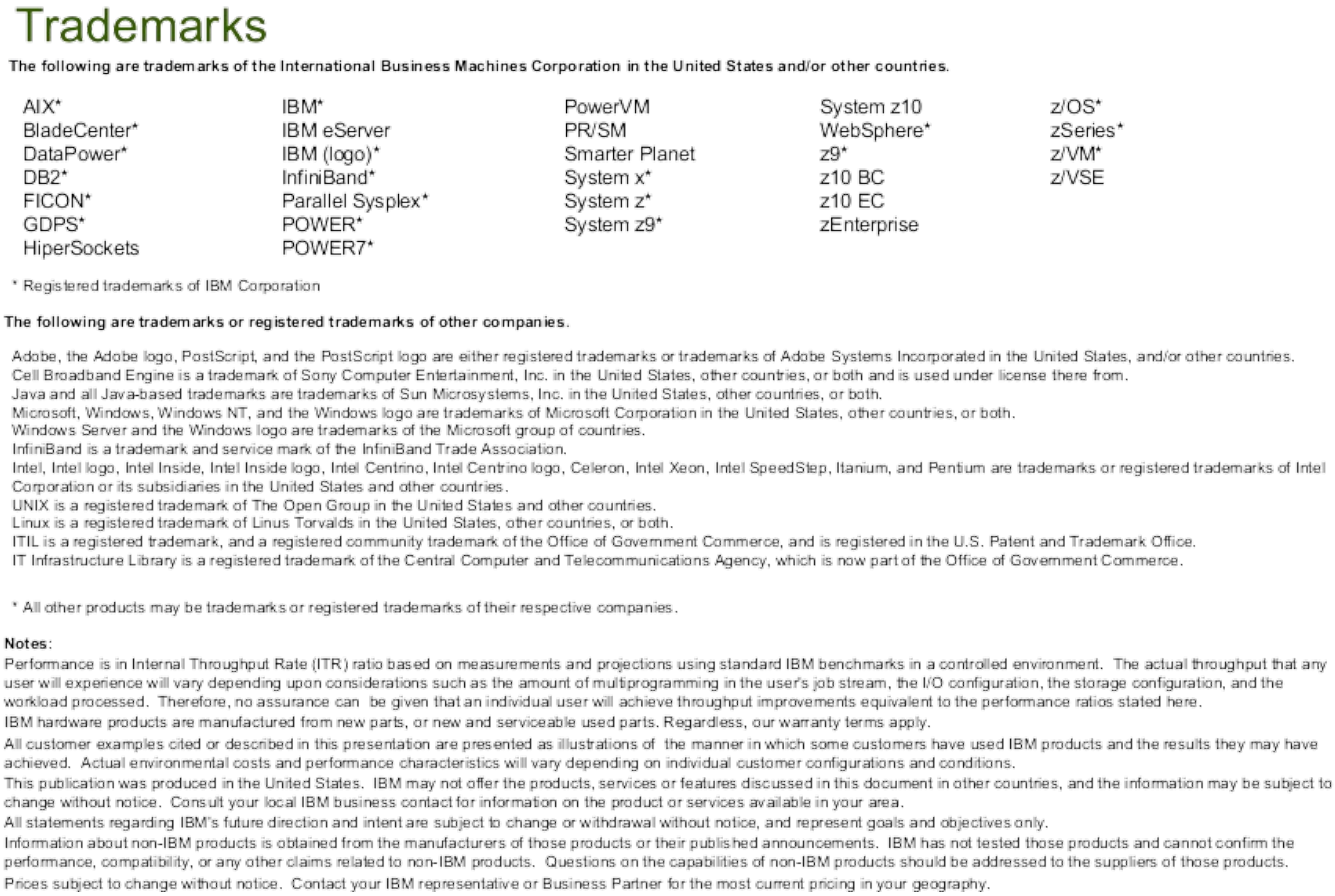

Trademarks

Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

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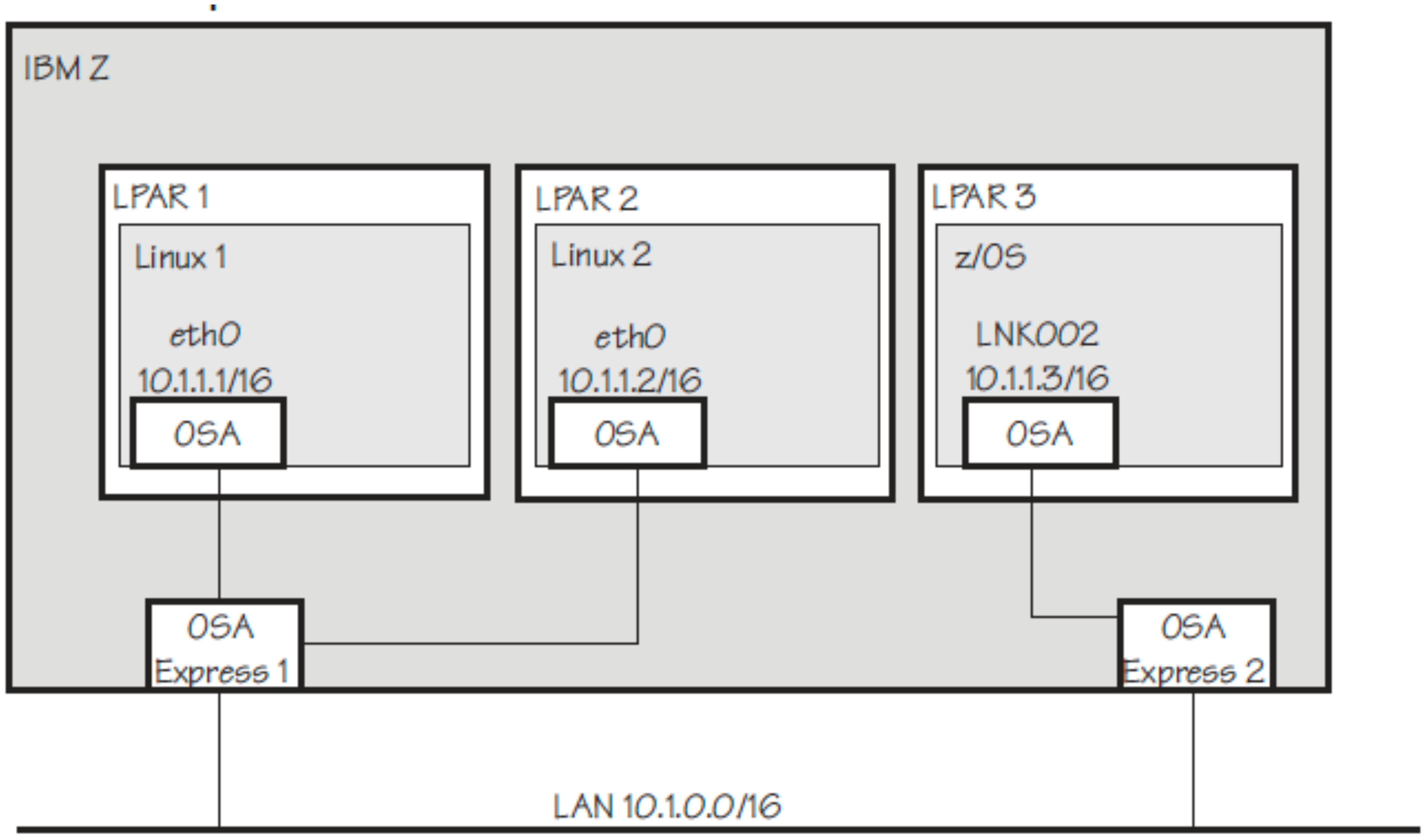
IBM zSystems aka Mainframes

Logical Partitions (LPARs)



HiperSockets

Provided by Hardware / Firmware

(memory to memory moves)

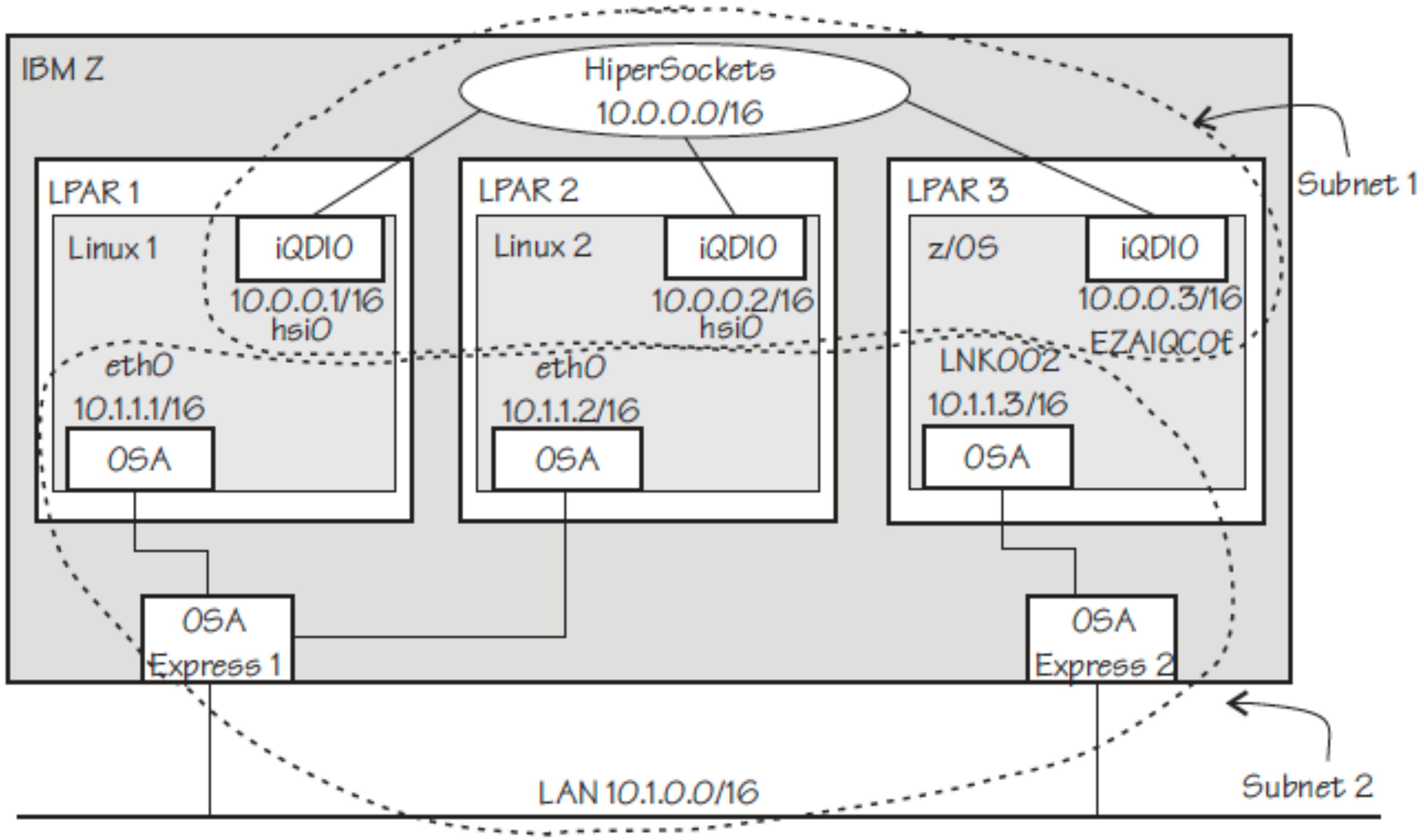
Low latency / high throughput ☺

But:

Additional subnets

Routing rules, etc.

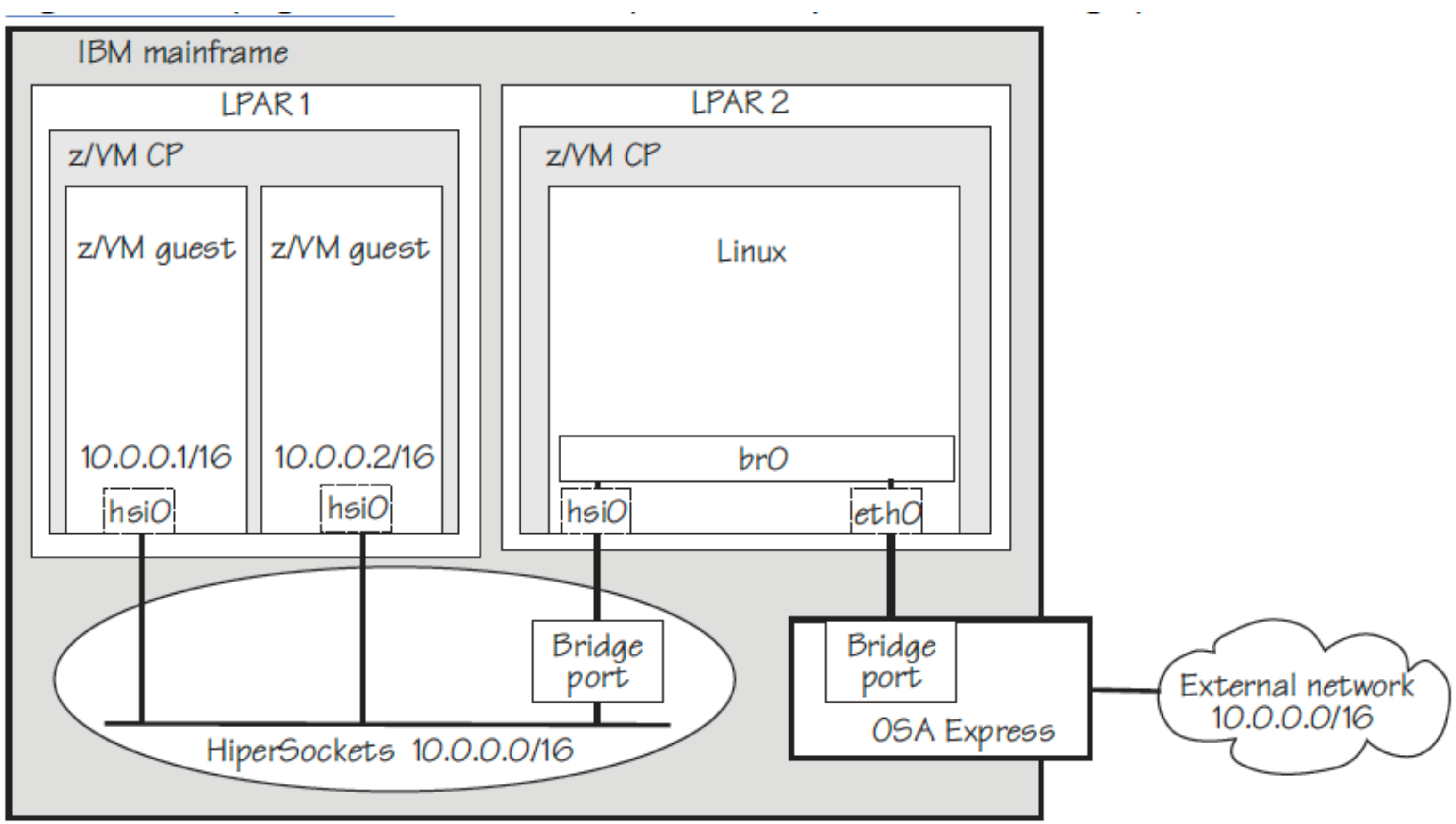
☹ “I want single-homed systems that can be deployed anywhere”



“use a bridge”

😠 :

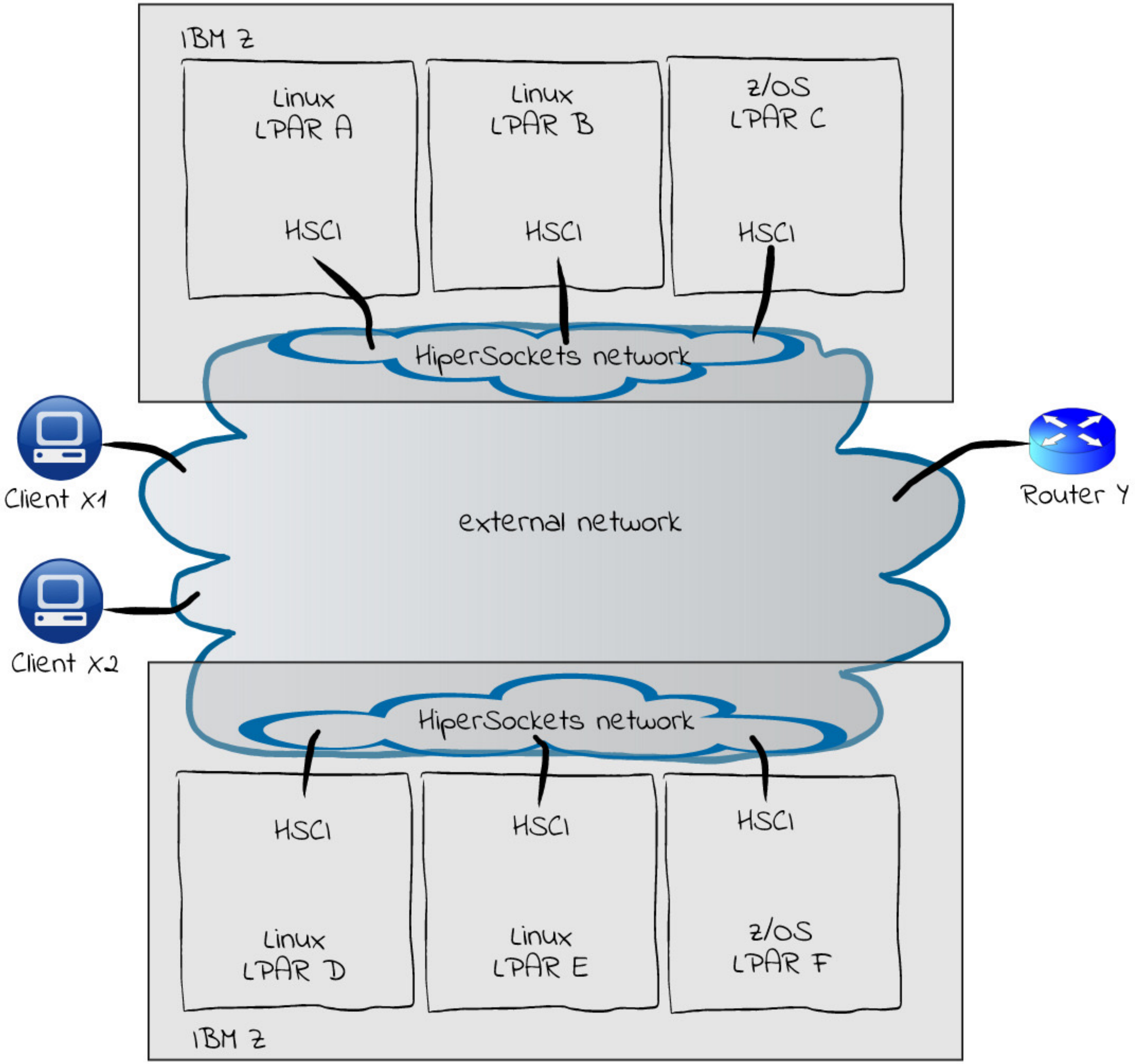
- Performance bottleneck
- Extra hop
- Single point of failure



HiperSockets Converged Interface - HSCI

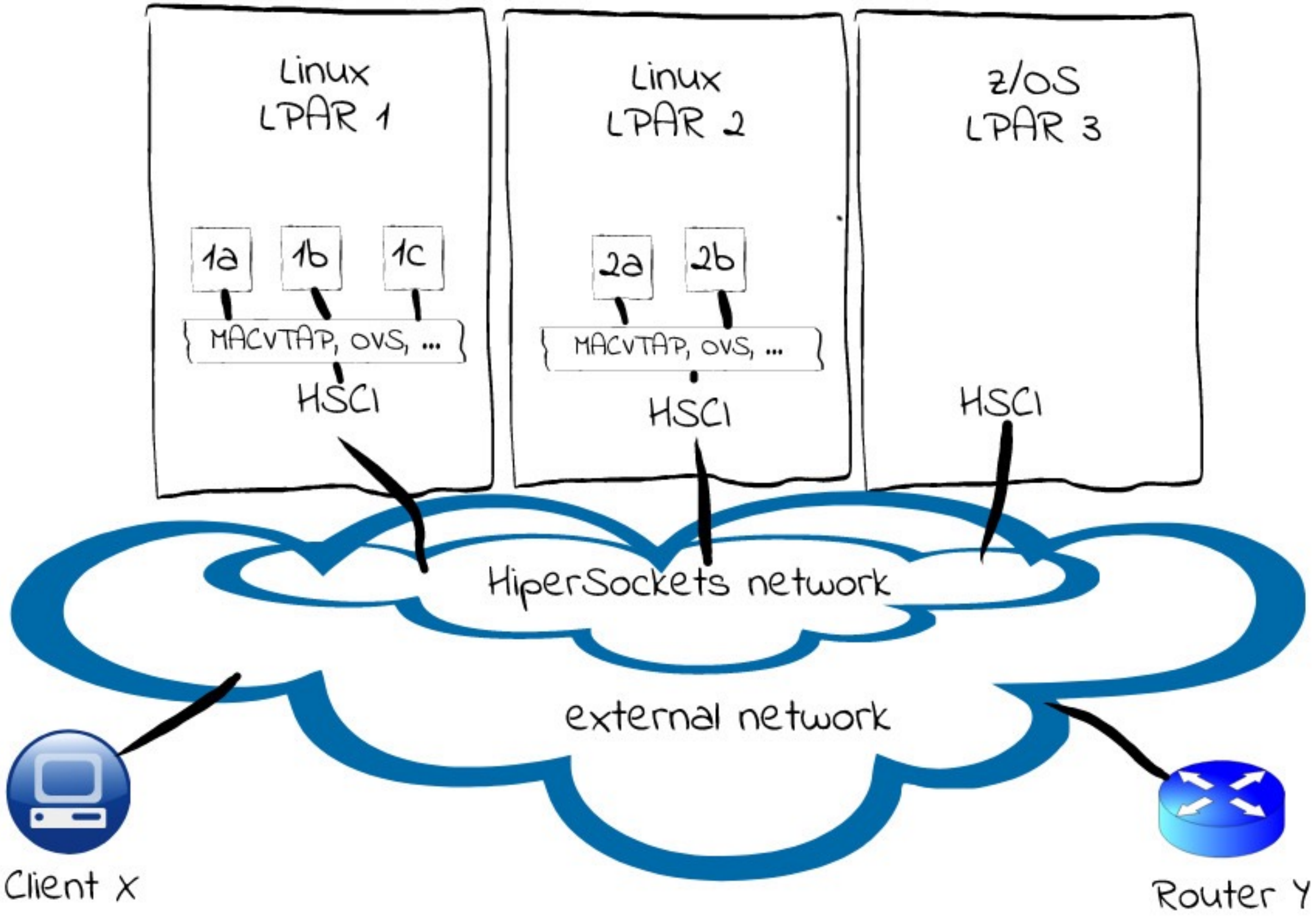
- Single interface per system
- Choose HiperSockets if possible
- Chose default NIC otherwise

☺ 👍



Support virtualization

- Multiple target MACs on top of HSCI
- Dynamic add/del of instances
- (Live) migration



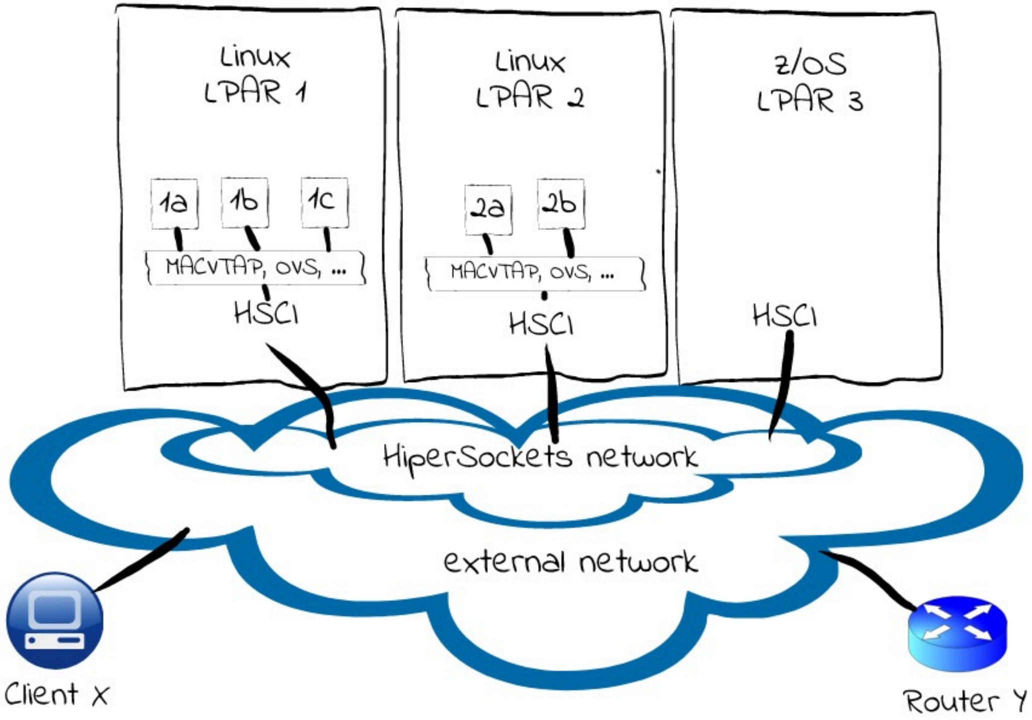
To consider:

- No (broadcast) loops
- Need a forwarding database (FDB) with (learned) source addresses and (learned) target addresses

  What is reachable via HiperSockets?
- Chicken-egg problem with MAC learning on HiperSockets interface (risk that it is never used)
- Don’t rely on gratuitous ARP messages
- Ageing of obsolete entries

HiperSockets Firmware provides for:

- Query FDB of network segment
- Events in case of FDB changes



Options for implementation

- Hardware / Firmware

-> additional buffer copy

- BPF
- ebtables
- Open flow

-> working prototypes, but all required FDB implementation in user space

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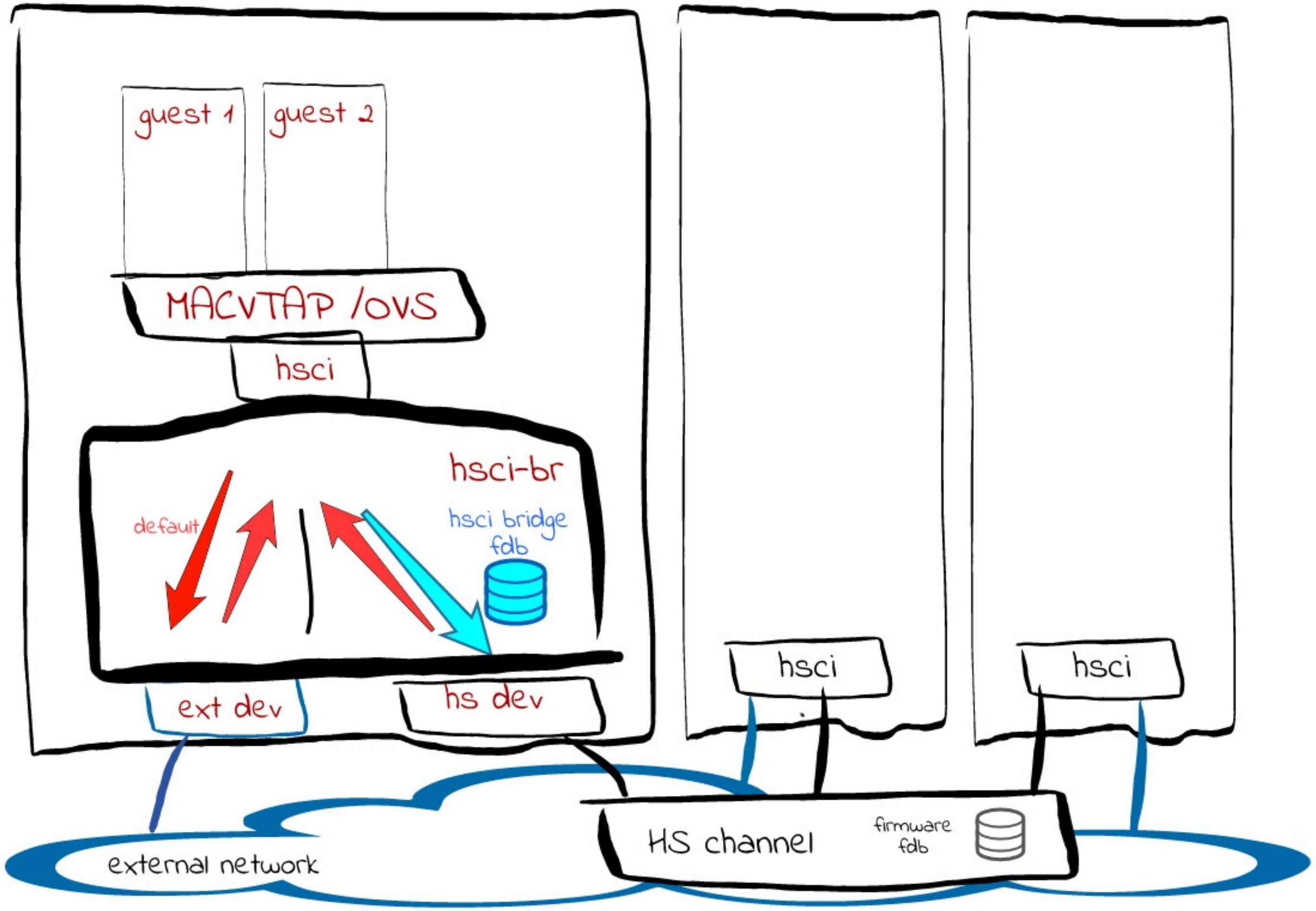
- Bridge and switchdev

-> almost all required features exist already

Configure linux bridge as HSCI

- No loops:
  - stp off
  - ext dev: isolated on
  - hs dev: isolated on
  - hsci: isolated off
- ext dev as default:
  - ext dev: flood on
  - hs dev: flood off
  - hsci: flood on
- hs dev if possible
  - fdb entries
  - ext dev: learning off
  - hs dev: learning off
  - hsci: learning on

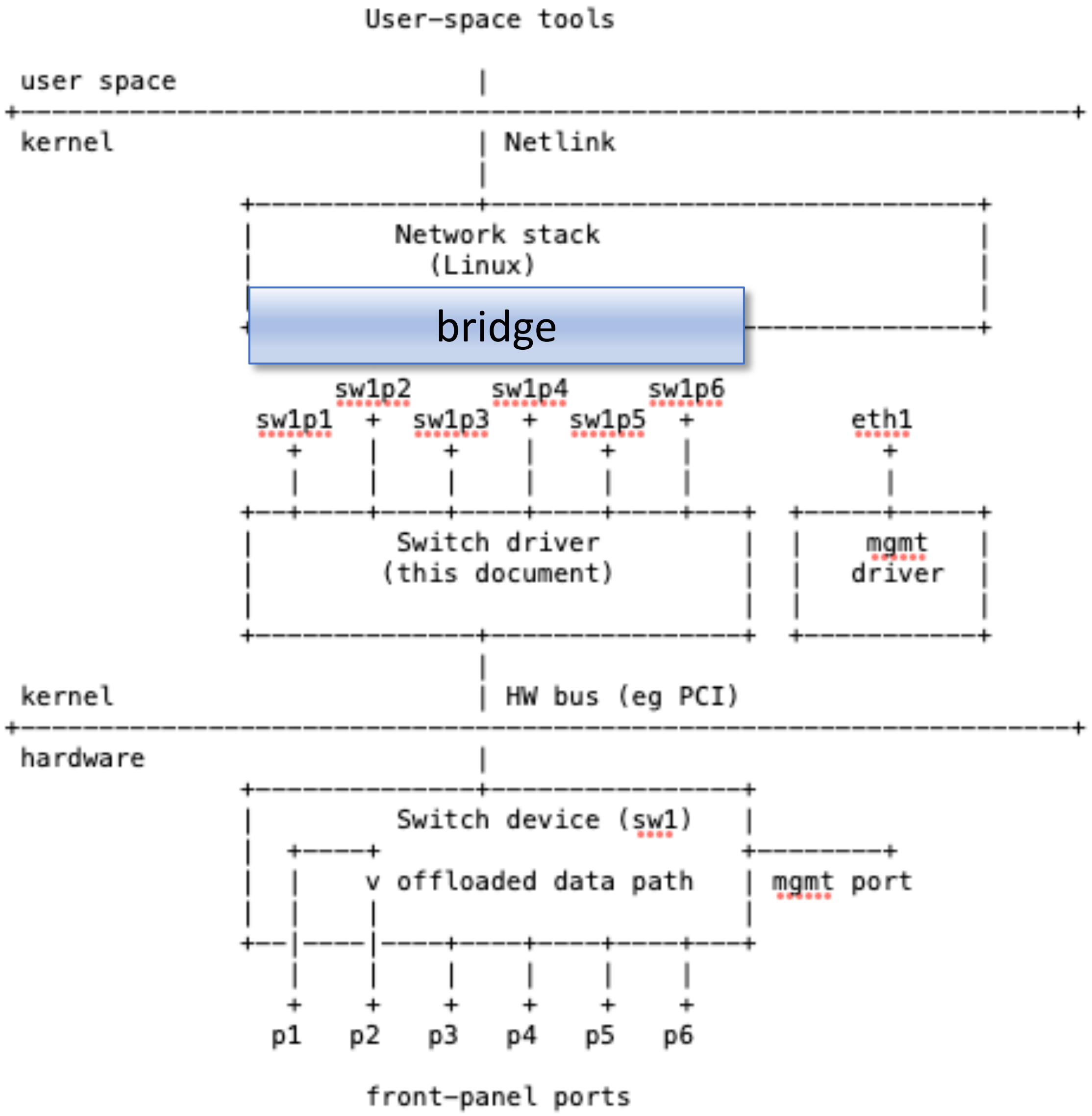


Switchdev

- Documentation/networking/switchdev.rst

- Device to bridge notifiers:
    - SWITCHDEV_FDB_ADD_TO_BRIDGE
    - SWITCHDEV_FDB_DEL_TO_BRIDGE

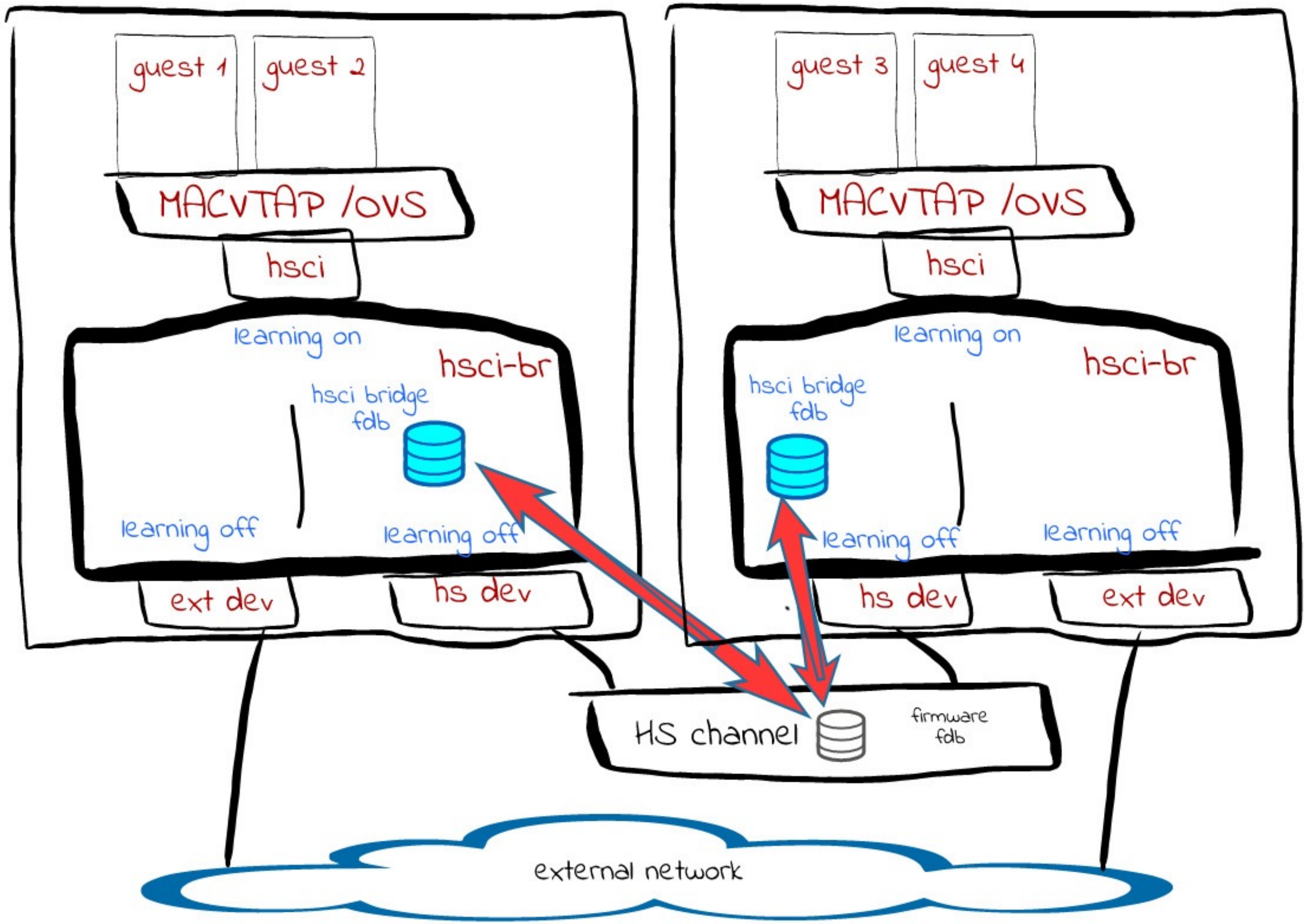
- Bridge to device notifiers:
    - SWITCHDEV_FDB_ADD_TO_DEVICE
    - SWITCHDEV_FDB_DEL_TO_DEVICE



Notifiers

Example:

- Add guest 2
- hsci port on left bridge learns source MAC
- Notification to HS channel
- Notification to right bridge: guest 2 is reachable via HiperSockets



How to turn notification on and off?

- Need to preserve legacy behaviour of HiperSockets interfaces (default)
- linux/Documentation/networking/switchdev.rst :

  > **learning_sync** attribute enables syncing of the learned/forgotten FDB entry to the bridge's FDB.

- `man bridge link set :`

  > **learning_sync on** or **learning_sync off**
  > Controls whether a given port will sync MAC addresses learned on device port to bridge FDB.

- => `bridge link set dev $hsdev learning_sync on self`
- Controls subscription to and generation of notifications by HiperSockets interfaces
- No need to change bridge code (generation and subscription is always on for bridgeports)

Summary

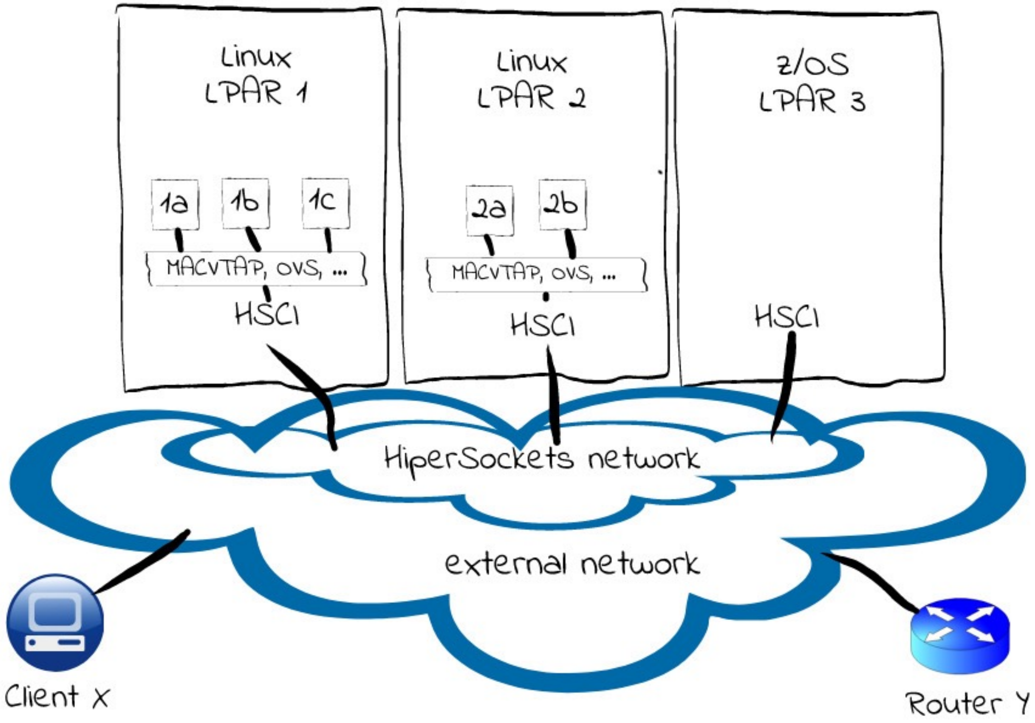
HiperSockets Converged Interface:

- Efficiently converged the external network and an internal preferred network segment
- Used existing bridge and switchdev behaviour
- Additions to HiperSockets device driver:

```
10a6cfc0fc82 s390/qeth: Translate address events into switchdev notifiers
817741a8eaa2 s390/qeth: Reset address notification in case of buffer overflow
780b6e7db25e s390/qeth: implement ndo_bridge_getlink for learning_sync
521c65b64916 s390/qeth: implement ndo_bridge_setlink for learning_sync
60bb1089467d s390/qeth: Register switchdev event handler
4e20e73e631a s390/qeth: Switchdev event handler
f7936b7b2663 s390/qeth: Update MACs of LEARNING_SYNC device
```

- Addition to bridge code:

```
d05e8e68b07c bridge: Add SWITCHDEV_FDB_FLUSH_TO_BRIDGE notifier
```



Open issues

- Bridge over bond:

Unlike MACVLAN, interfaces on bridgeports do not get notified in case of bond failover. So the attached guests do not send GratArps.
See

https://lore.kernel.org/netdev/20220329114052.237572-1-wintera@linux.ibm.com/

- HiperSockets support very large MTUs. How can HSCI benefit? Bridge needs to settle on lowest MTU of all bridgeports. Investigate whether Segmentation Offload can help.