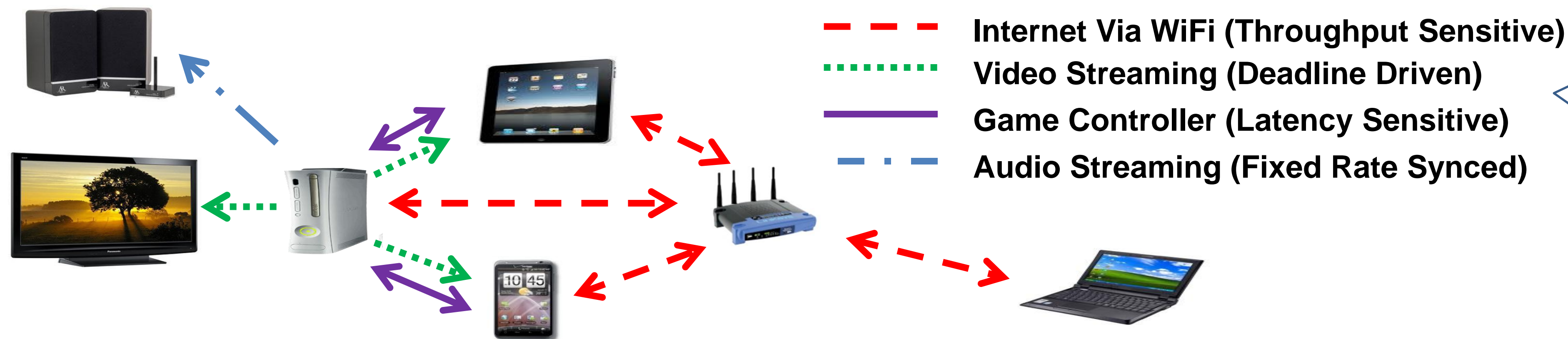


Picasso: Flexible RF and Spectrum Shaping

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Motivation: Our personal gadgets increasingly play host to a rich and diverse set of concurrent wireless applications

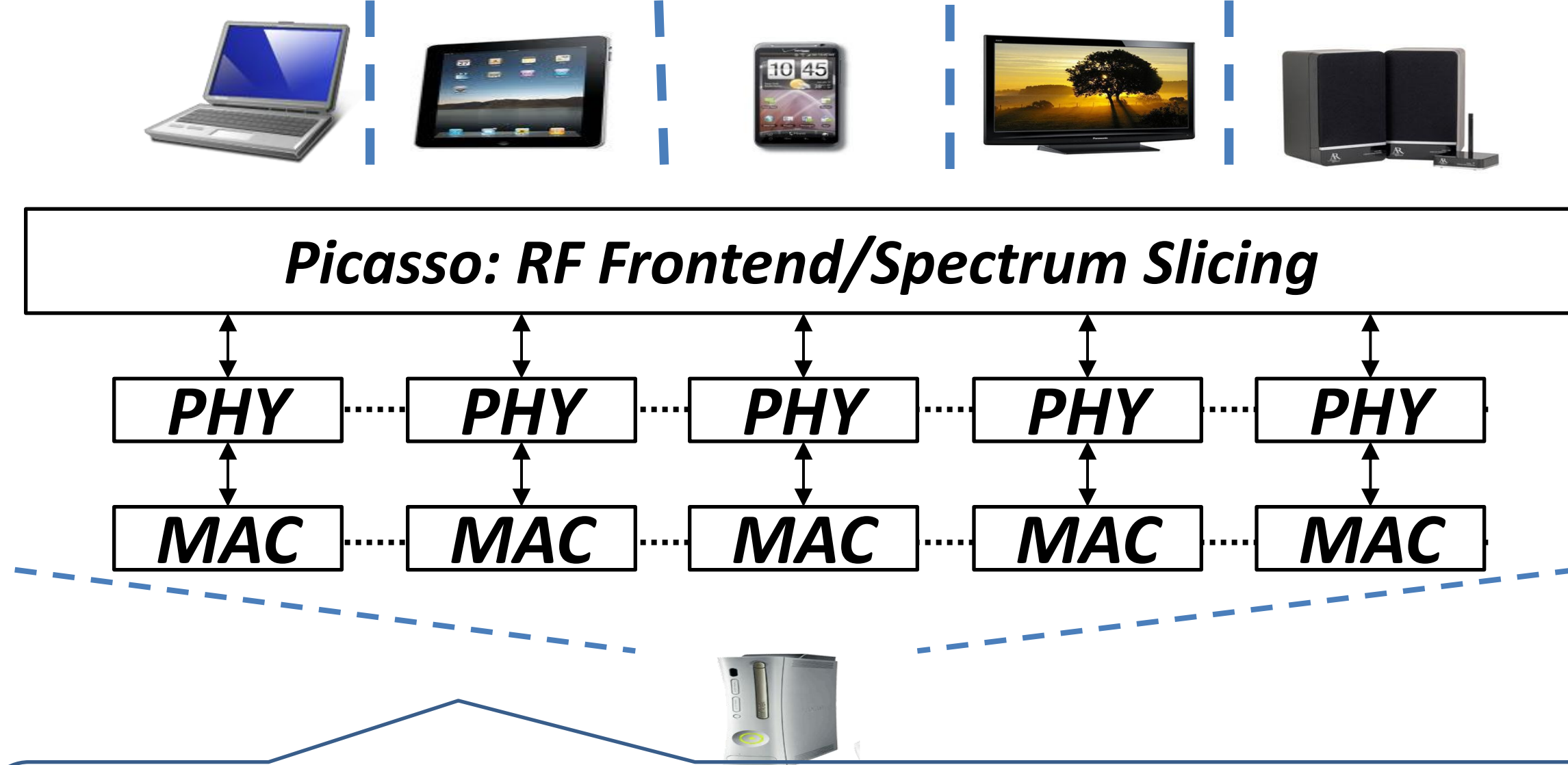


Ideally each network would be decoupled, but networks have to *share* scarce resources:

- RF Frontend:** Only room for a single frontend to be shared by all networks. Devices cannot transmit and receive simultaneously on different bands
- Spectrum:** Available spectrum is arbitrarily fragmented by interference.

Portable devices have to provide all these features often with a **single RF Frontend** operating in the **fragmented ISM band**

Novel Picasso Design



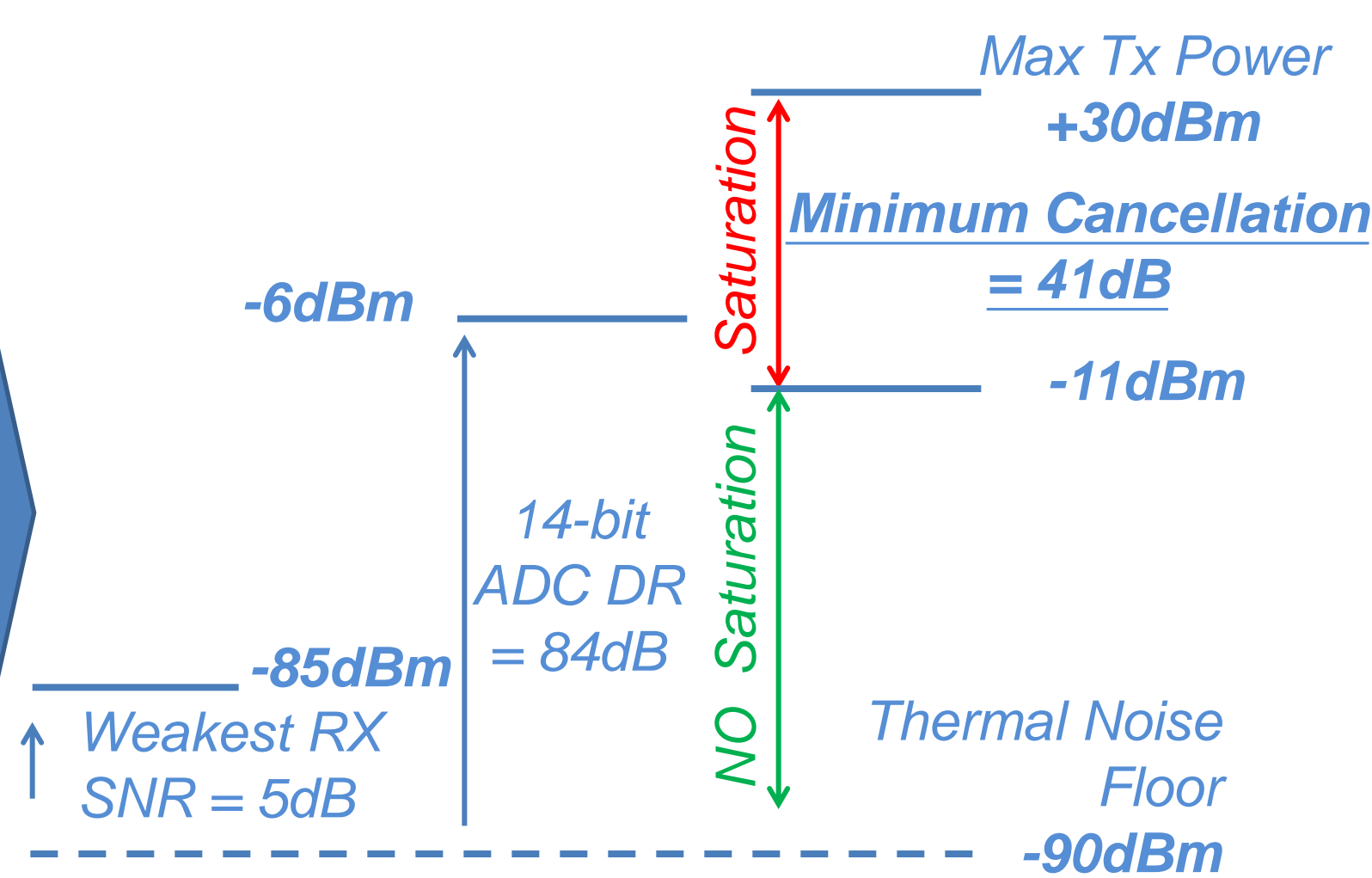
- Picasso can:**
- slice** the same infrastructure into multiple networks
 - customize** network for a specific application

Picasso decouples through **RF Frontend/Spectrum Slicing**

Key Design Challenges

RF Frontend Slicing Challenge

- Prevent Receiver Saturation

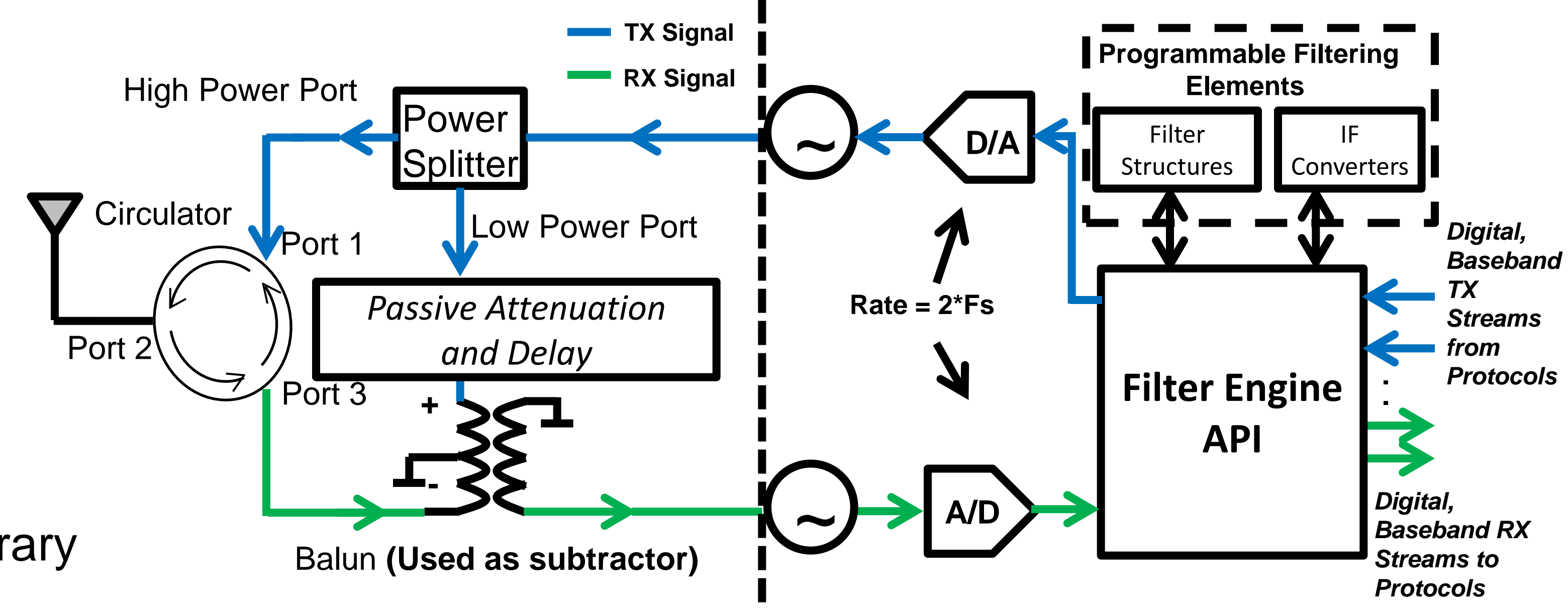


Spectrum Slicing Challenge

- Utilize spectrum fragments of arbitrary widths and center frequencies

RF Frontend Slicing Solution

- Self Interference Cancellation

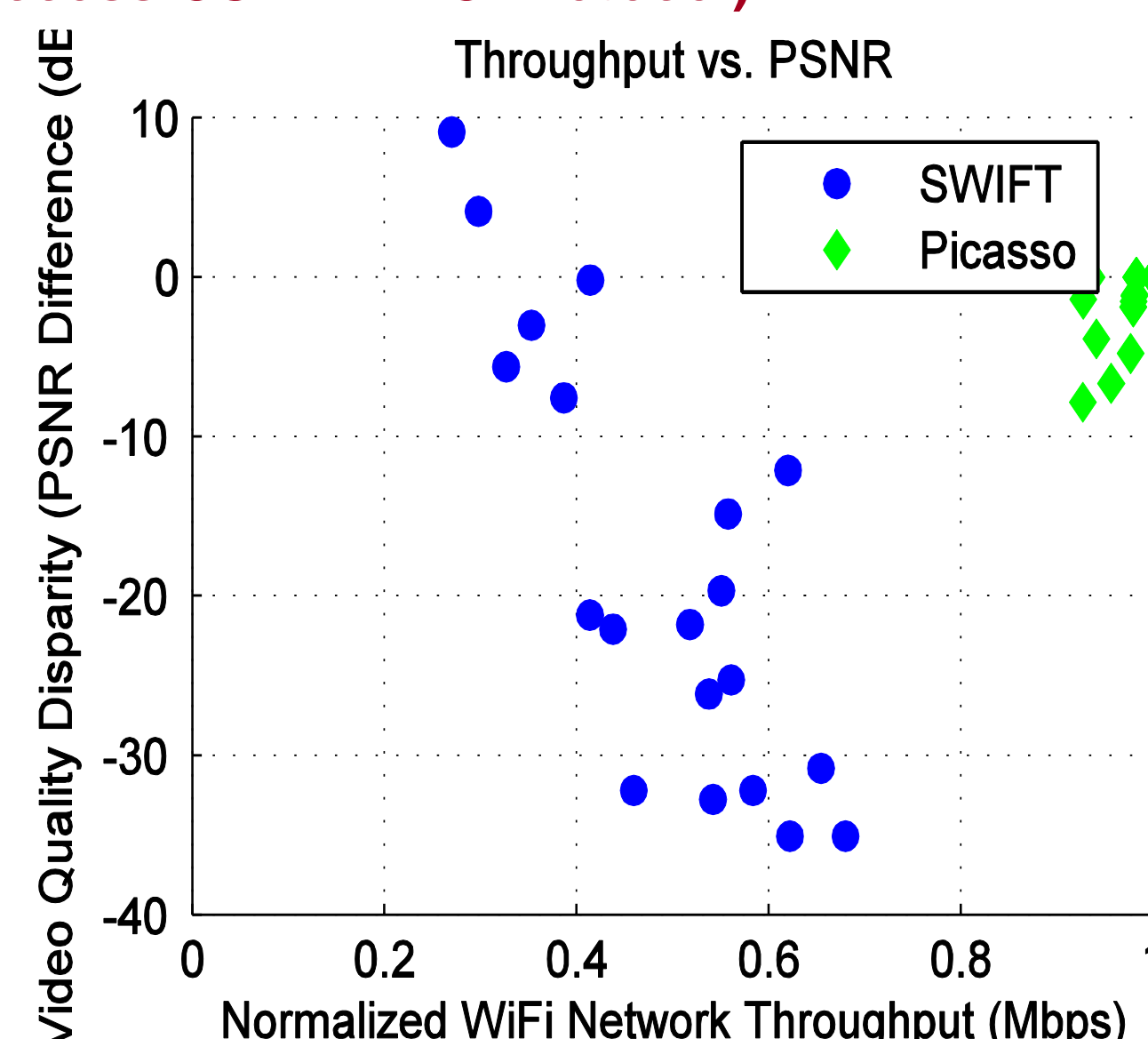
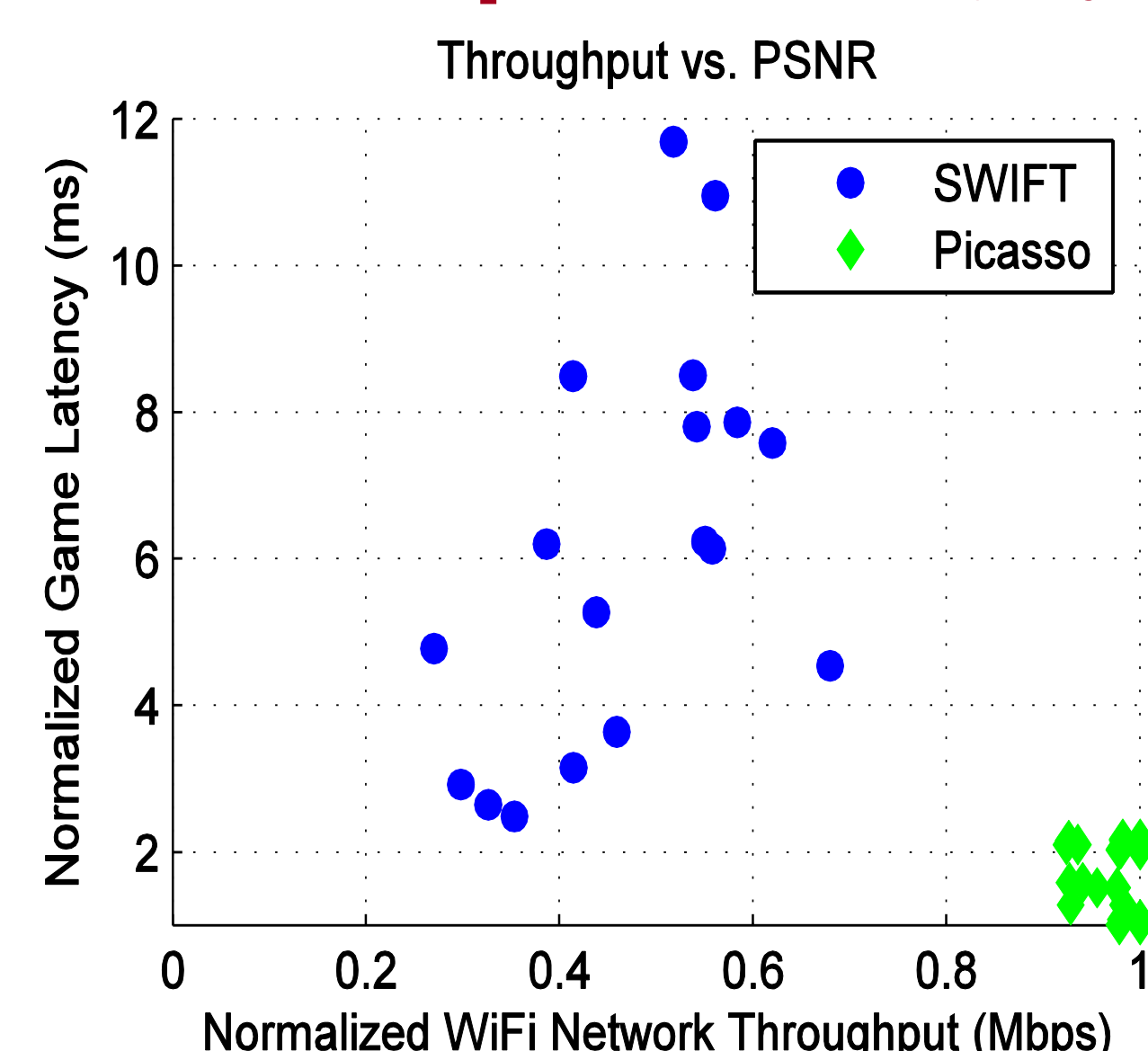
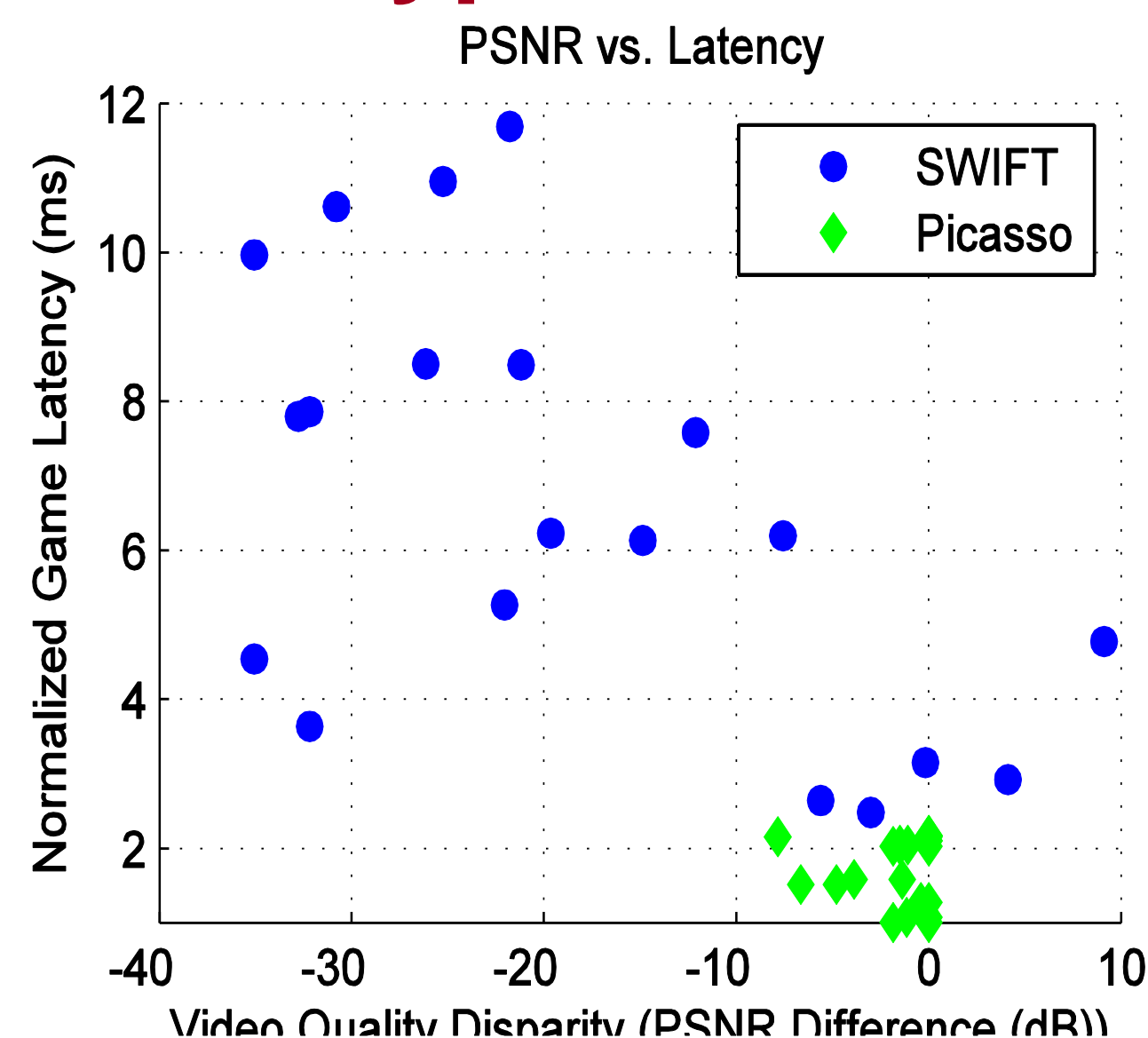


Spectrum Slicing Solution

- Reconfigurable digital filtering

Prototype Results: SWIFT Comparison

SIGCOMM 08 (OFDMA Fragment Aggregation with Random Access CSMA MAC Protocol)



Picasso provides latency and deadline **guarantees** while still maximizing throughput

Summary

- Picasso is a **key enabler** for rich and diverse networks to flexibly share fragmented spectrum and RF frontends, yet operate in a decoupled manner.
- Picasso builds on prior work (DOF^{SIGCOMM 11}) concerning coexistence with interfering sources

Future Work

- Design **an entire network stack** on top of Picasso to exploit multi-channel fragmentation, which includes a distributed access protocol and a multi-pathing transport protocol
- Explore germane applications** (e.g. cellular fragmentation, white space networks, multi-channel mesh networks)