

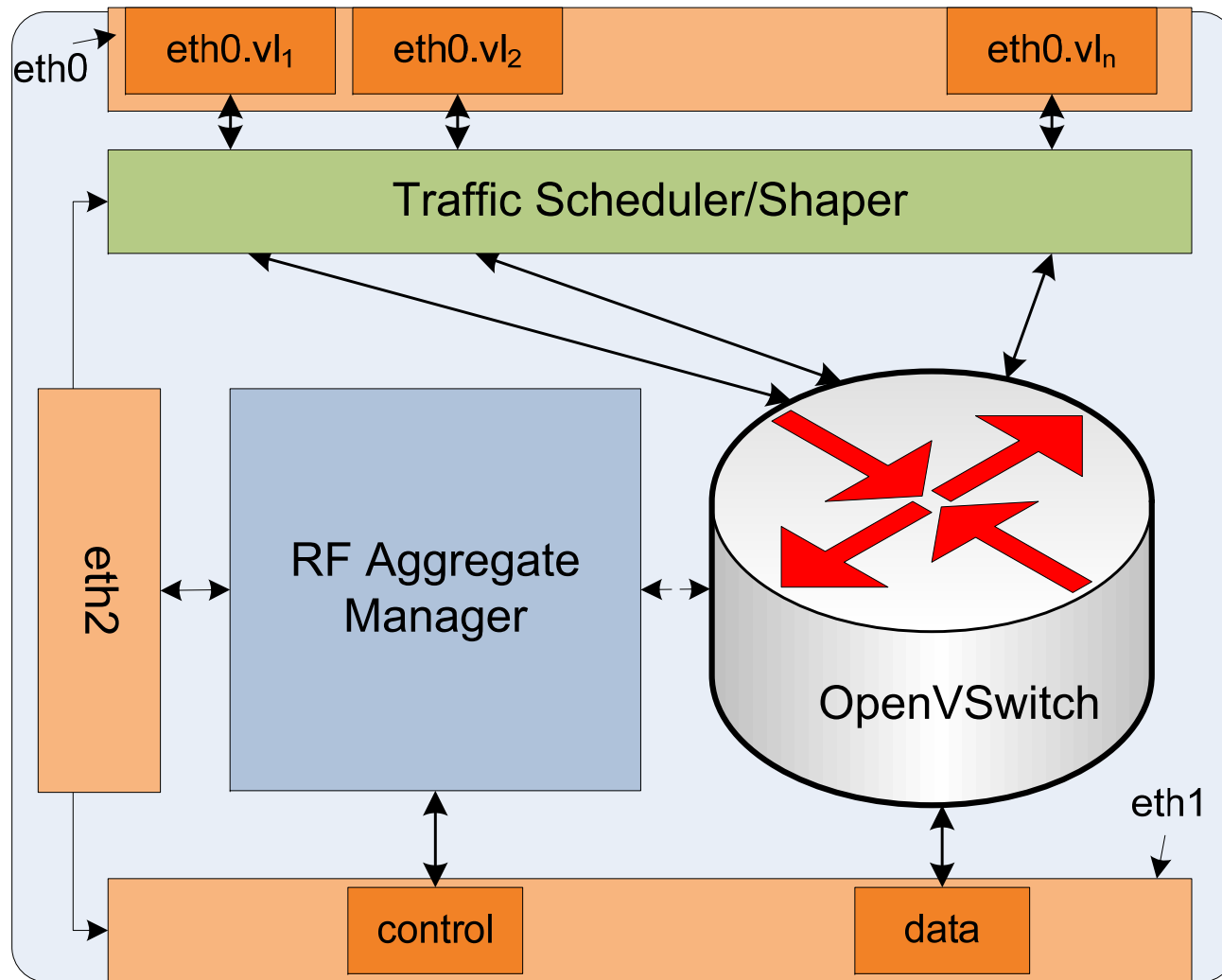
GEC19: A Vision for GENI Wireless Infrastructure

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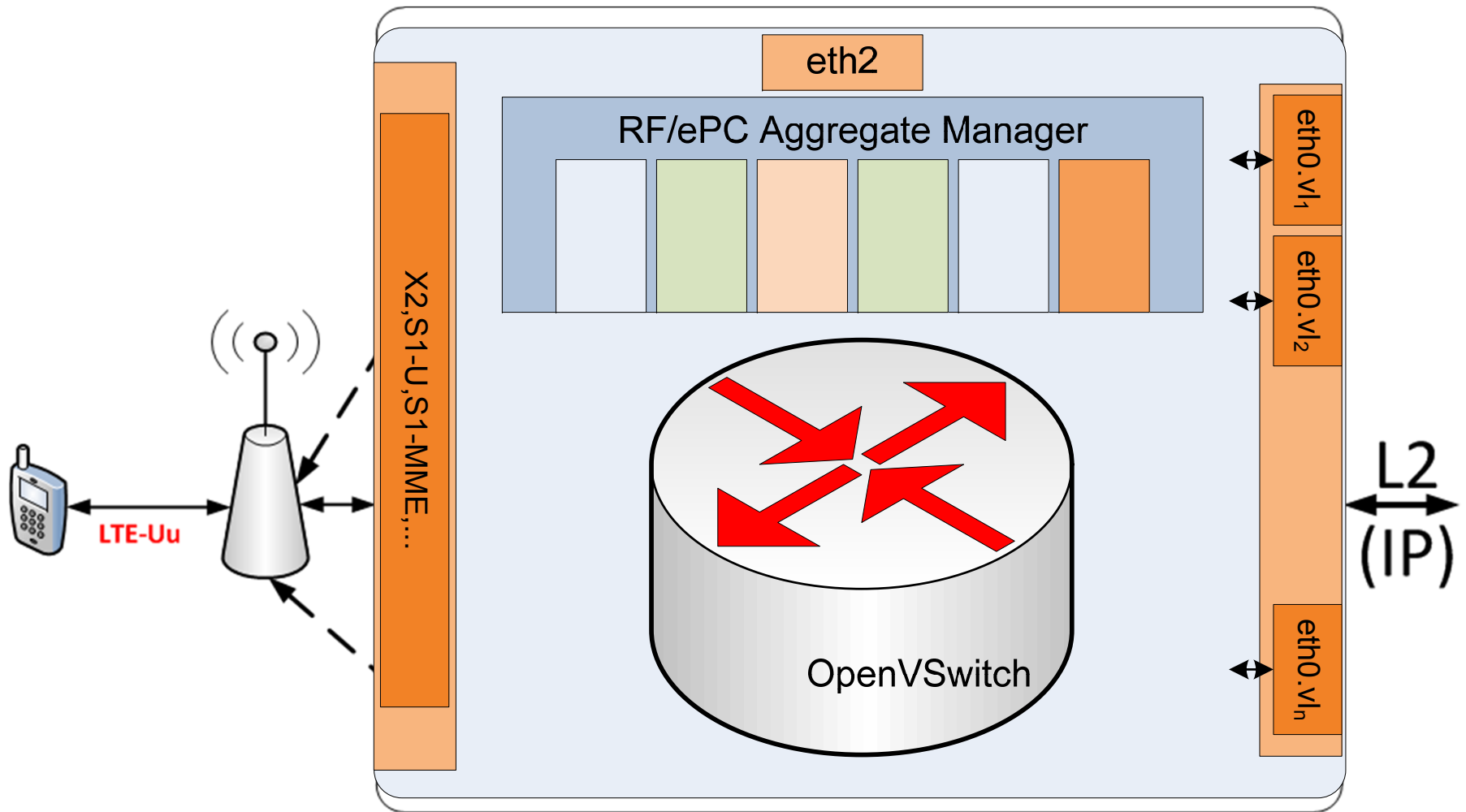
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Rutgers University

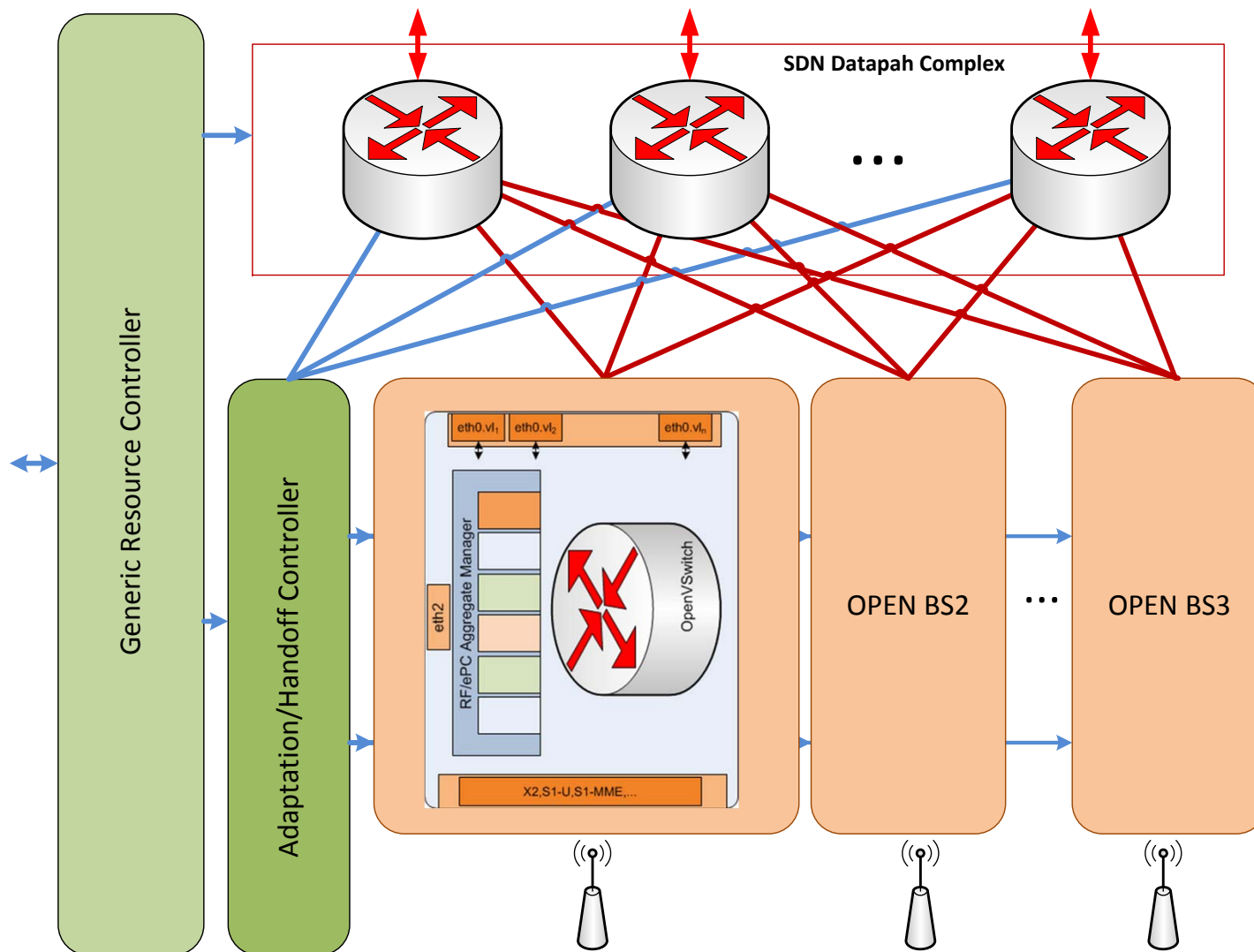
OPEN BTS: WiMAX



OPEN BTS: LTE

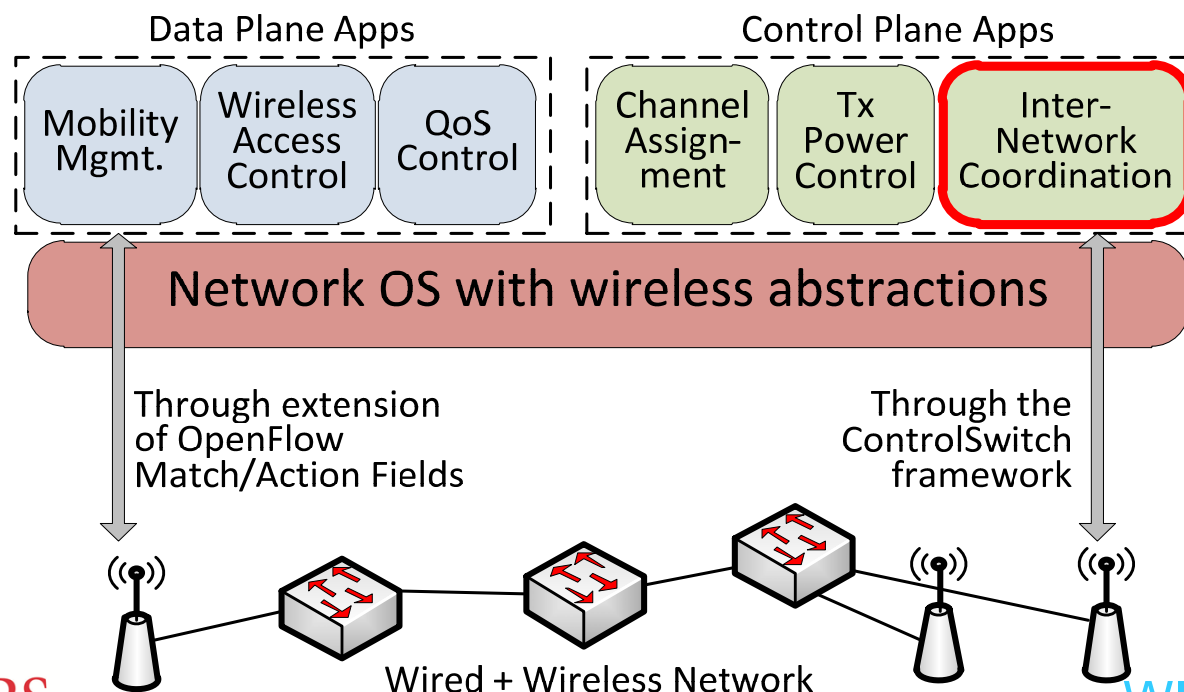


Larger Picture



SDN Approach to Wireless Control Plane

- Introducing flexibility in the wireless control plane by leveraging software defined networking techniques and enabling more complex experimentation
- Inter-network cooperation translates to inter-controller interactions and setting of flow-rules



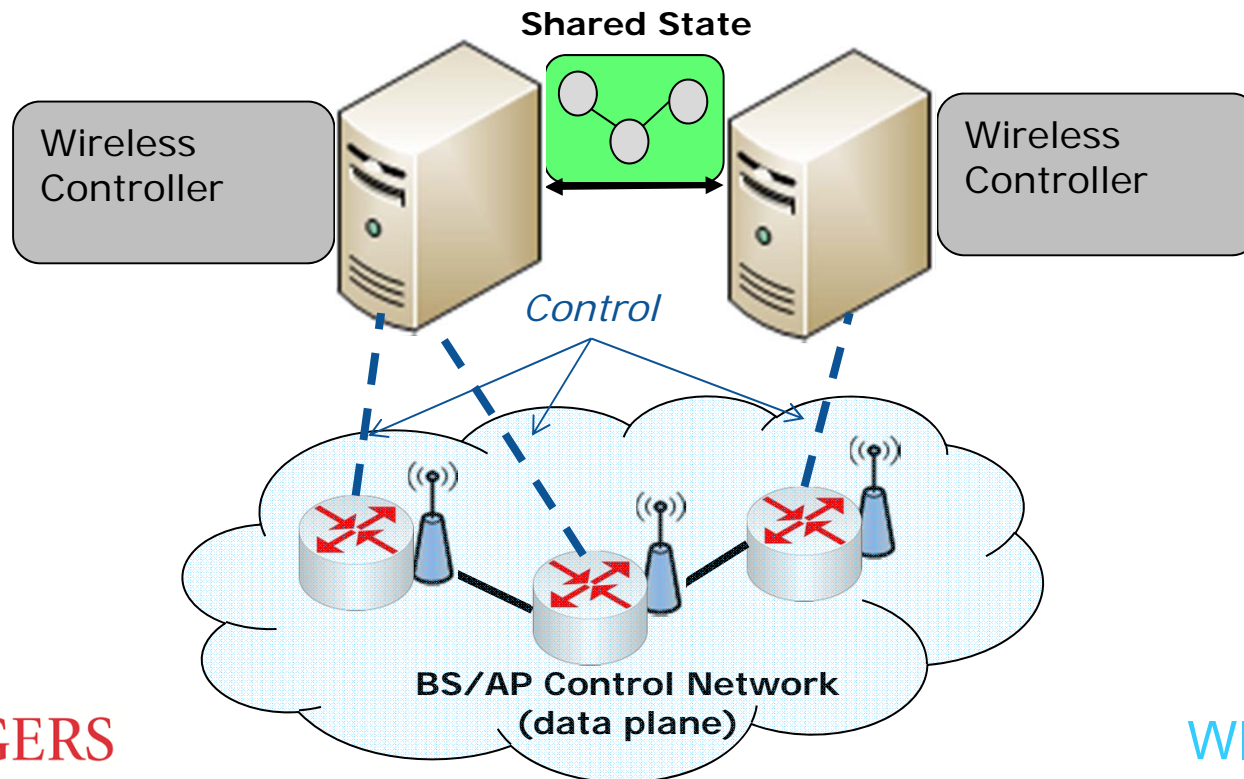
Match with GENI

- Centralized control not that clear a choice in wireless
 - Certainly leads to easier-to-write, globally-optimum algorithms
 - But at the cost of: (i) Scalability, (ii) Latency
 - Neighborhood view = Global view for setting channel, power, rate, ...
 - GENI Racks ideal for both types of control
- Most control functions require triggered/periodic messages
 - E.g. periodic load measurements are required to set best channel
 - A “control-flow” instead of one-shot configuration messages
 - Network provisioning for control plane is a must
- Can target all 3 objectives by programmatically managing the control-flows
 - Common across all 3: Need to determine which control messages go where: (i) neighboring vs. central controller, (ii) controller vs. addr of 3rd party service, (iii) own controller vs. another network’s controller

A: Distributed Control Plane

Extension of traditional Enterprise Controller:

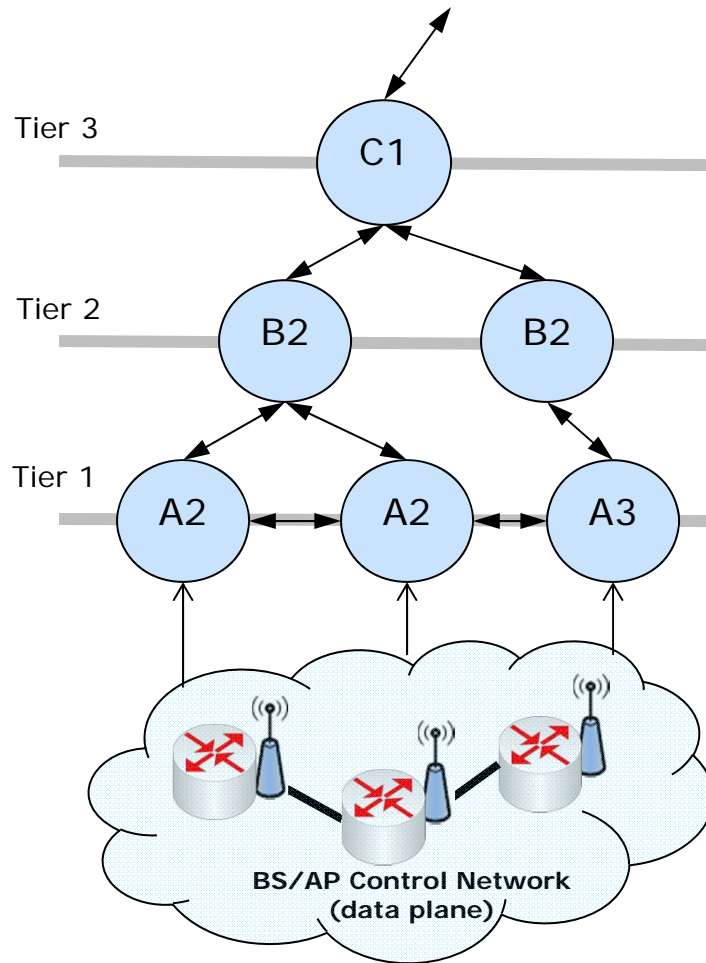
- ❑ Multiple copies of wireless controllers (WC) with mechanisms to cooperate, scattered throughout SDN based control plane
- ❑ Reduced distance between device and a controller – reduced flow setup times (reduced control latency)



B: Heterogeneous Distributed Control Plane

- Builds the control plane as a network of different controllers
 - Each controller is a part of a control stack
 - Controllers communicate by message passing
 - Multiple controllers process each event
 - SDN control plane can pick and choose services for each event, avoiding conflict
- Wireless Control Stack (WCS) realized as a complex interaction between controllers rather than (single) monolithic application

C: Heterogeneous Hierarchical Control Plane



- **Groups of functional WCS controllers arranged in tiers**
 - Higher tier events = more global and less frequent
 - Supports natural hierarchical inter-controller relations
- **Controllers connected with SDN inter-controller links**
 - Joins pieces of wireless control stacks together through SDN
 - Additional benefit: dynamic provisioning and routing for events to be moved between controllers and/or tiers (if they can't be handled at a tier)

OPEN RF Hardware Platforms



- ❑ “Ultimate experimentation platforms”
- ❑ Open-source implementation of major standards
- ❑ Not carrier grade
- ❑ Complexity
- ❑ (Missing) portable devices
- ❑ Problem with the license..