

## 5G/mmWave Capacity Improvements: A Systems Perspective

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# Research Question

***What is the fundamental trade-off  
between "sensing" &  
"communication"?***

- ❑ At microwaves: learn & leverage *interference* → cognitive radio and dynamic spectrum sharing
- ❑ At millimeter wave: learn *mobility* → beam alignment protocol design, beam alignment vs communication?

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Keywords:

Flexibility

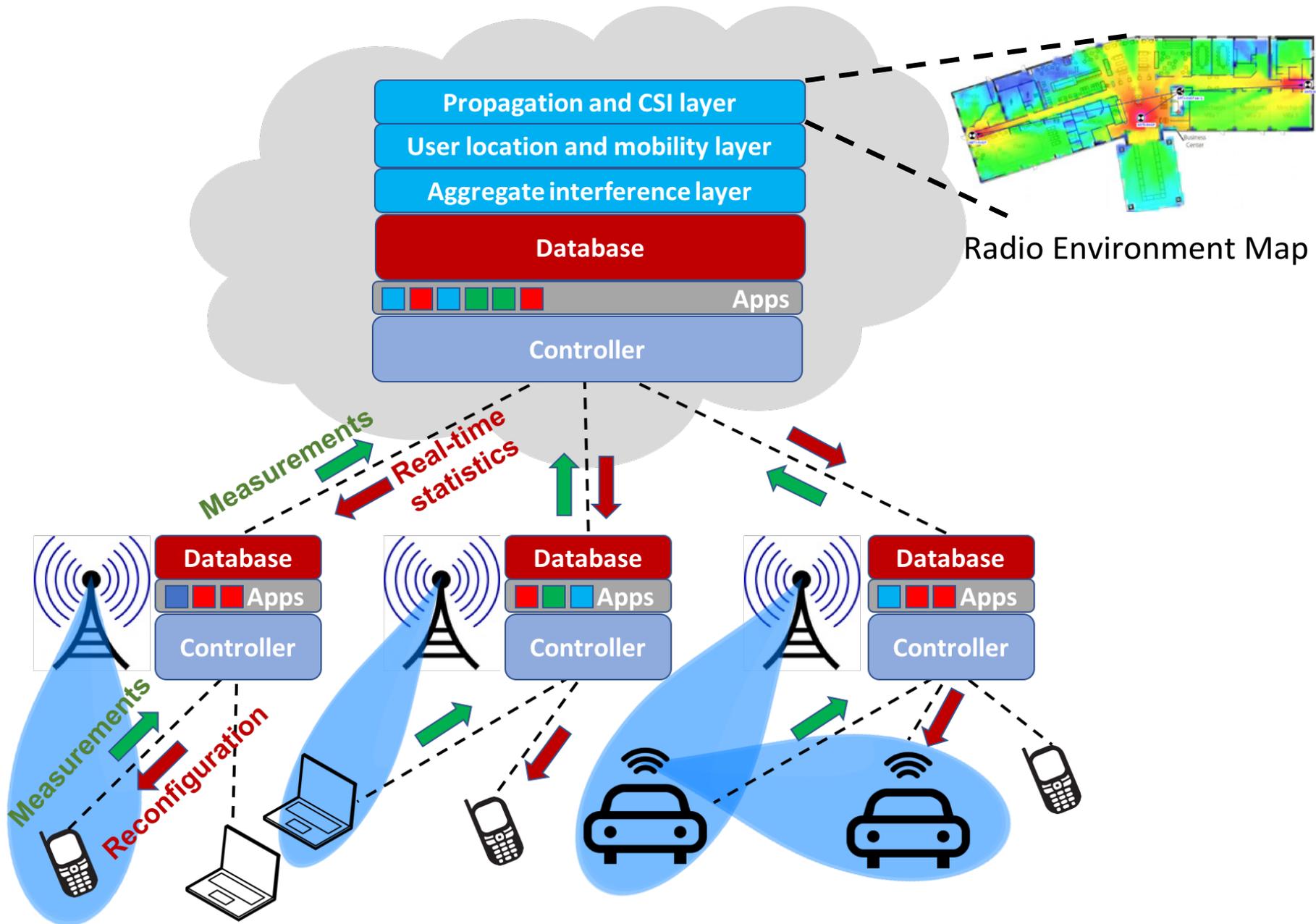
Situational awareness

Tools:

Software Defined Networking

Machine Learning

Cloud computing



# Spectrum mining?



## Microwave

Better penetration  
Ubiquitous channel

Low capacity  
Interference

...

*Massive IoTs*  
*Control plane*

## Mm-wave

Blockage/absorption  
Sensitive to mobility

High capacity  
Low interference

...

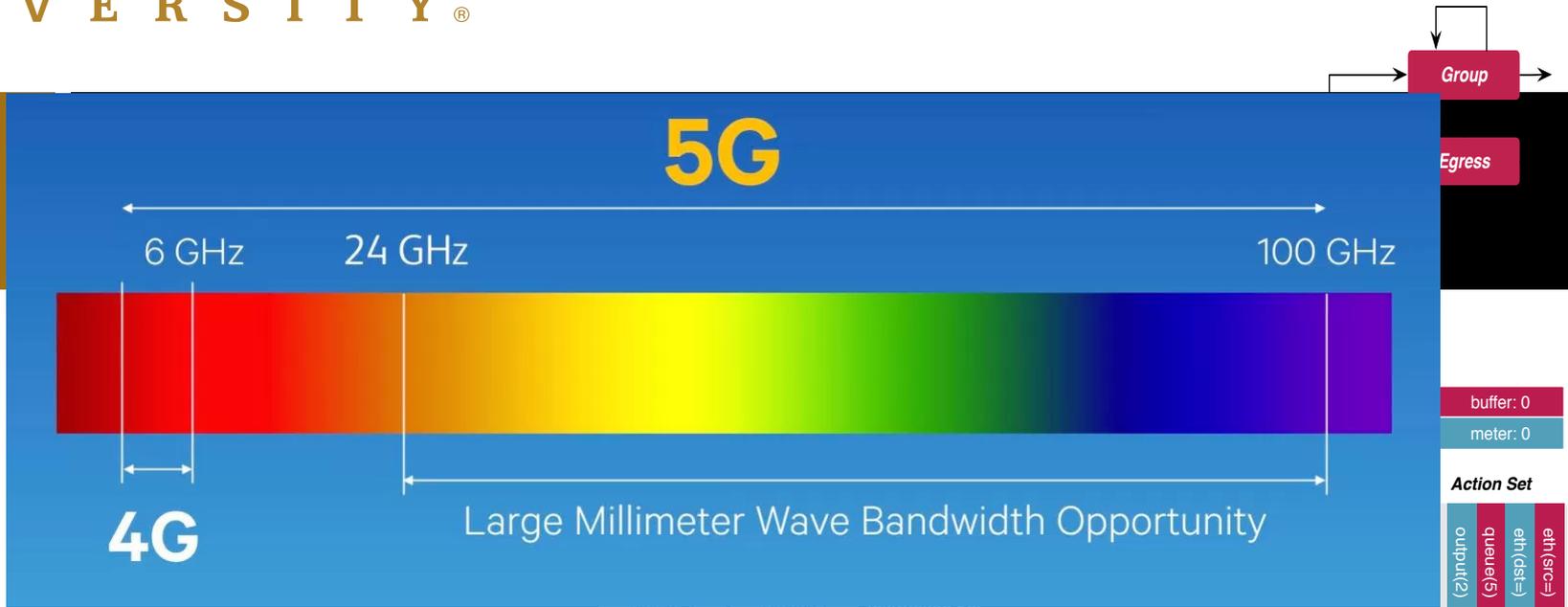
*Mobile broadband*  
*Mission critical IoTs*

# Grand Challenges

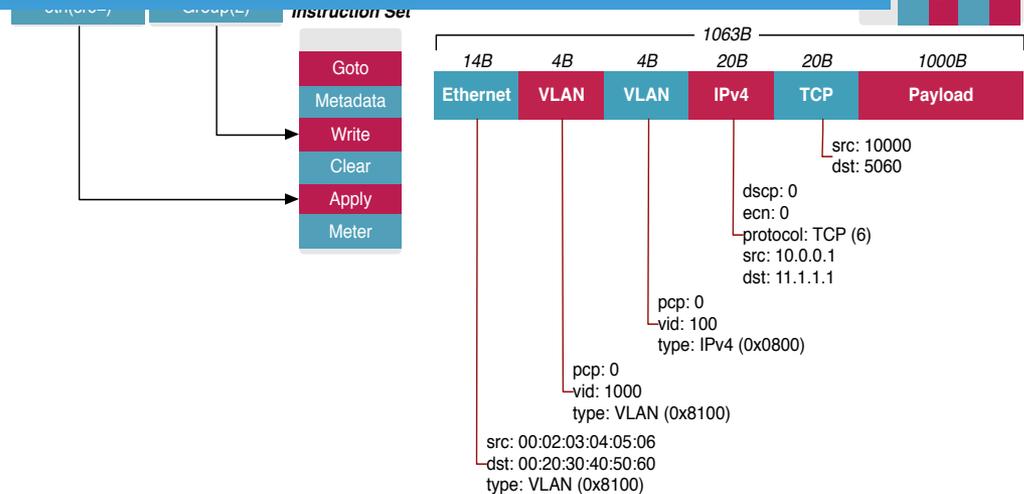
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*Rethink communication systems  
to leverage situational awareness  
via more flexible design*

- ❑ How much more can we squeeze at microwaves?
  - Limits not reached (yet!)
- ❑ Fundamental limit of mm-wave:  
sensing – communication trade-off?
- ❑ Abstractions?



[Source: National Instruments]



# SDN Framework Goals

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- ❑ Enable programmability at MAC & PHY layers
- ❑ Enable different per-packet behaviors
- ❑ Define & incorporate wireless primitives
- ❑ Abstractions?

