

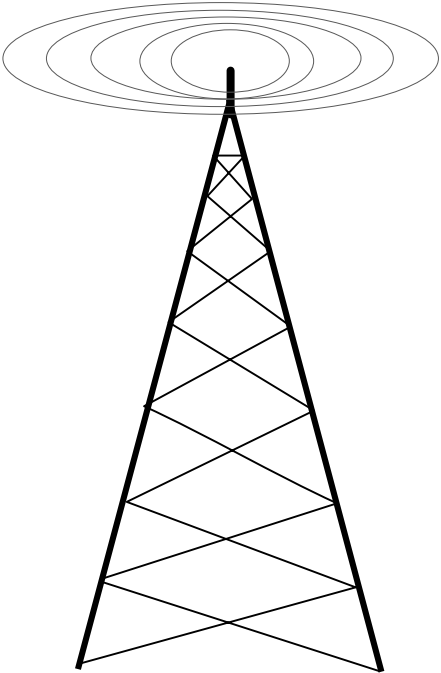
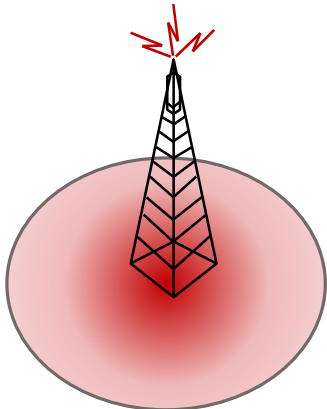
# The 2 definitions of Heterogeneous Networks (HetNets)

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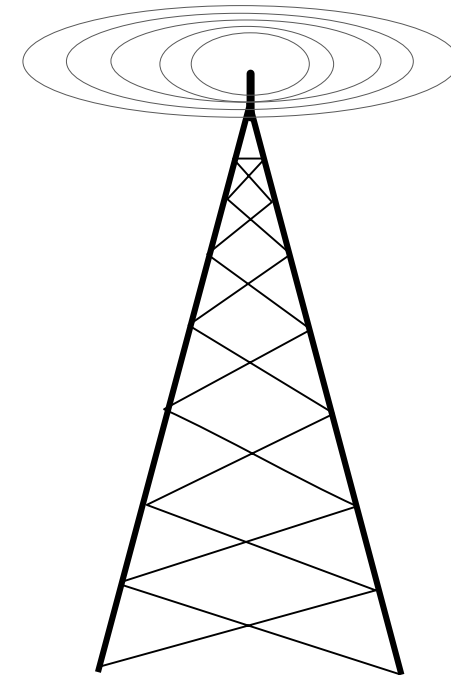
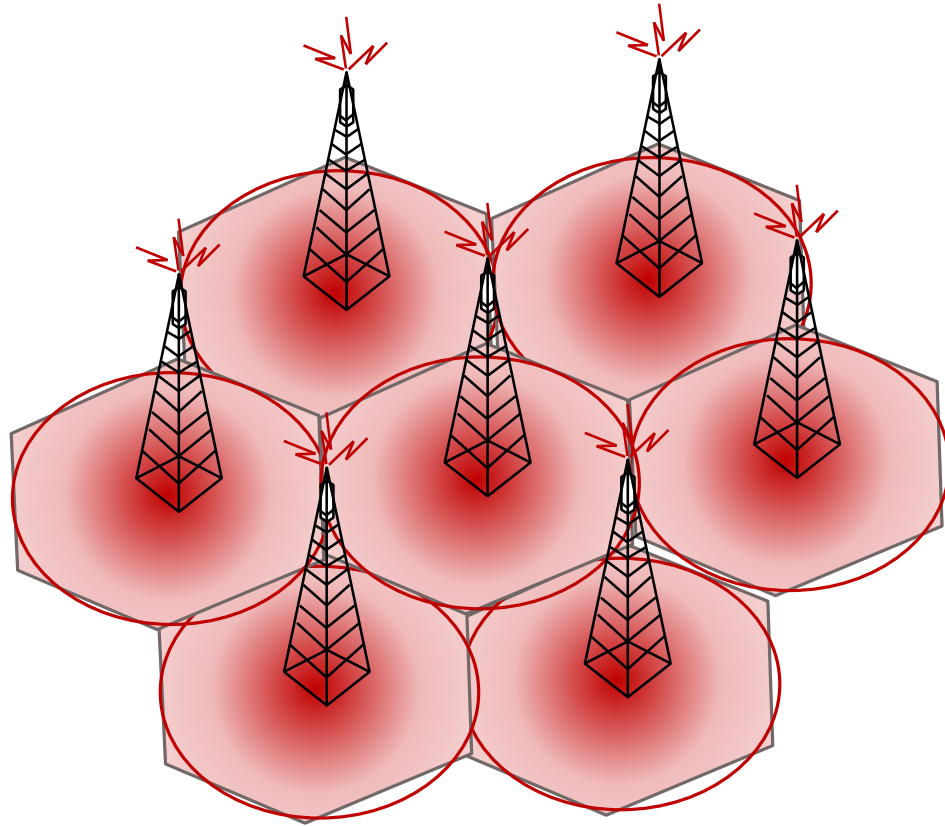
# Mobile Towers in Theory

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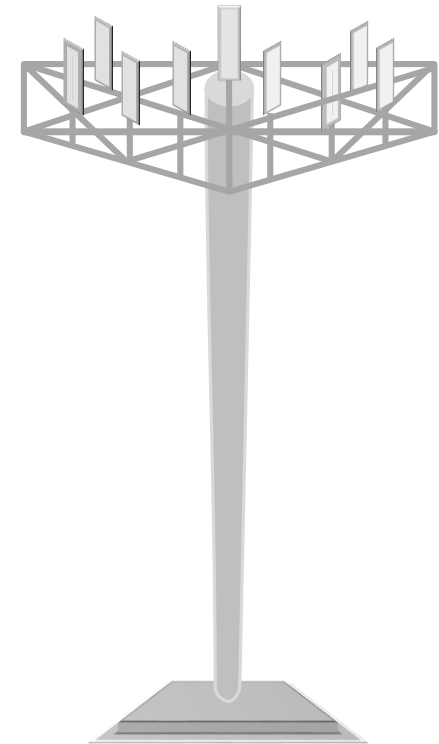
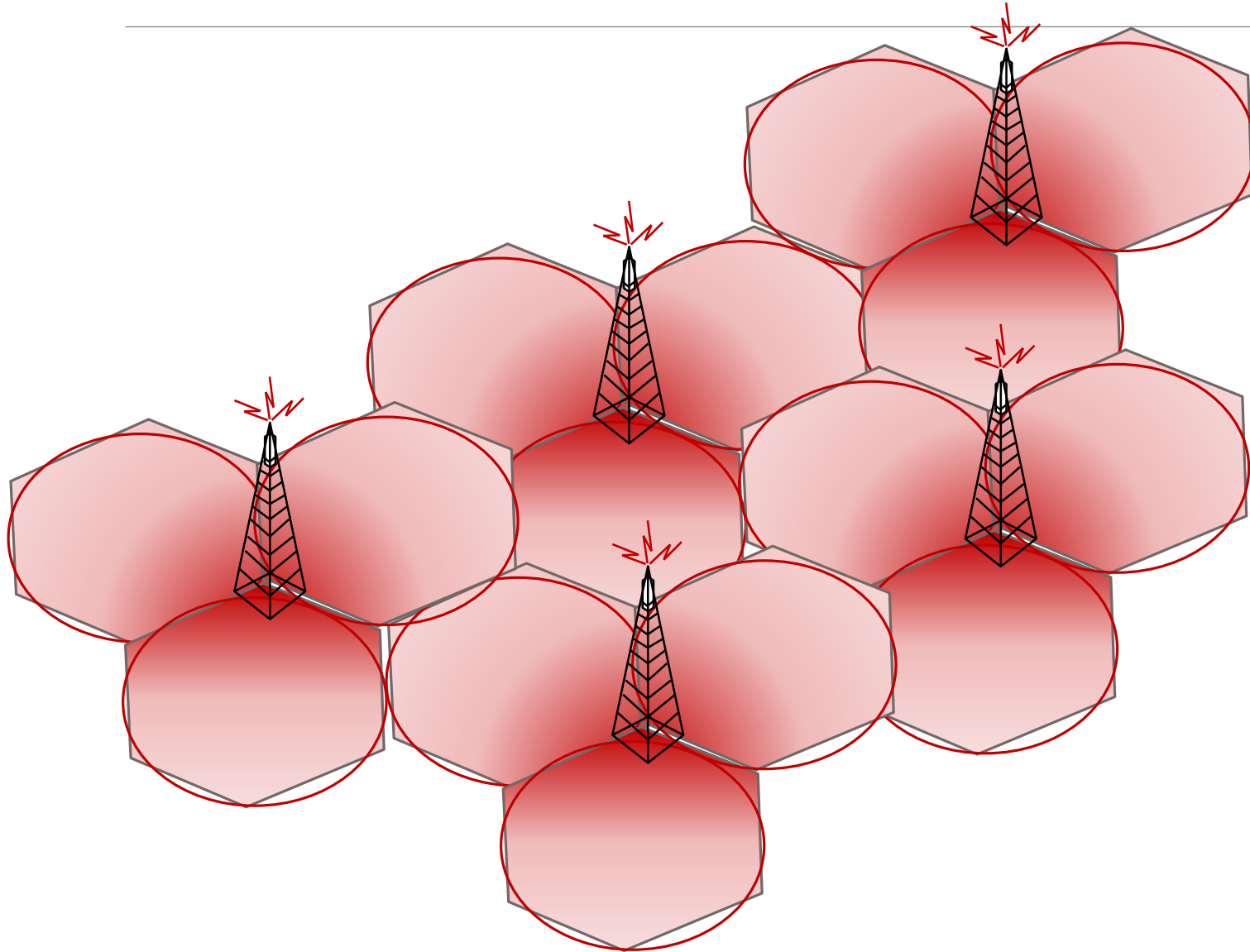
# Mobile Towers in Theory

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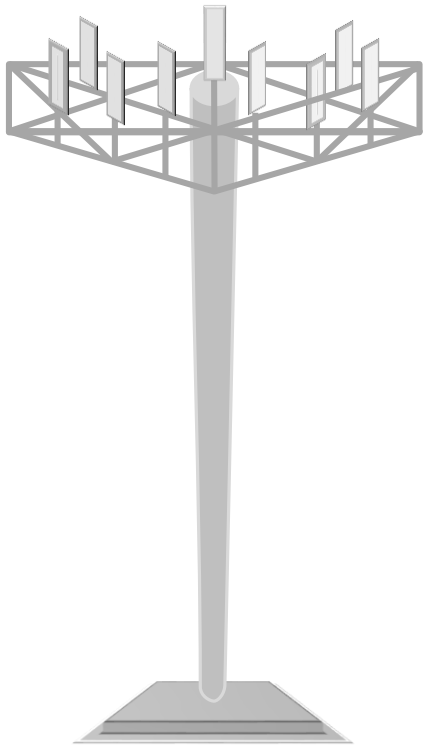
# Mobile Towers in Practice

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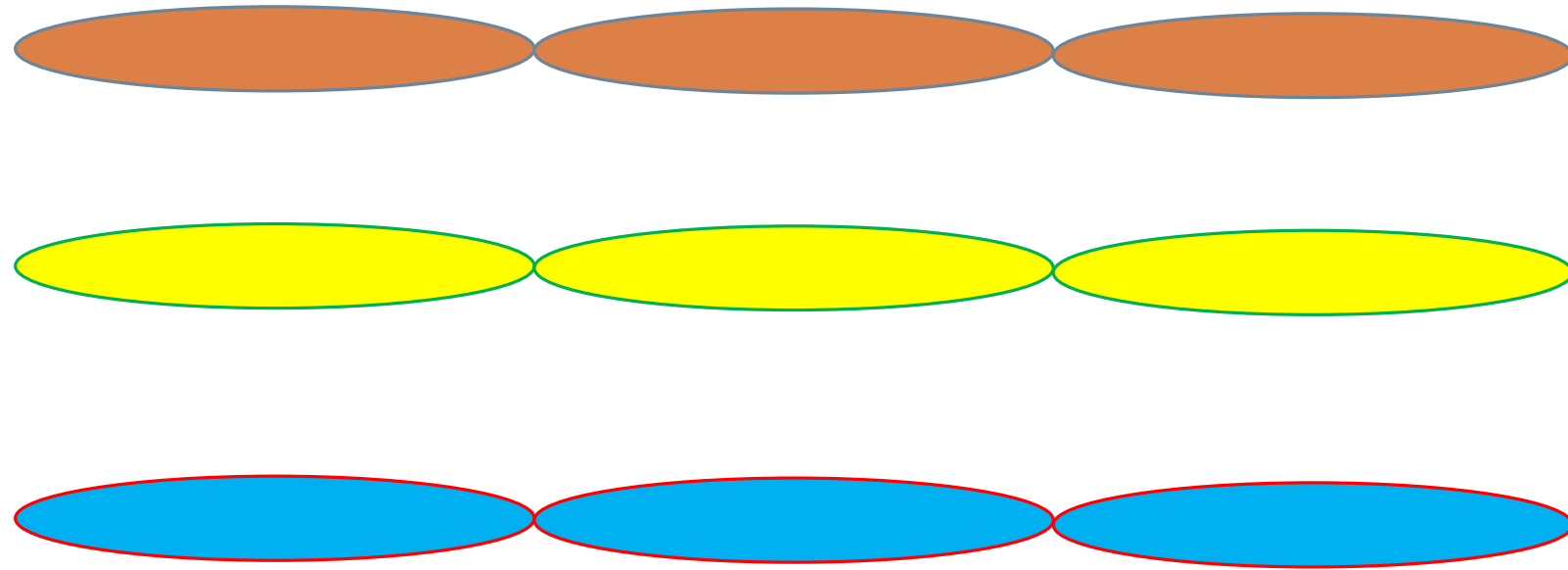
# Homogeneous Network

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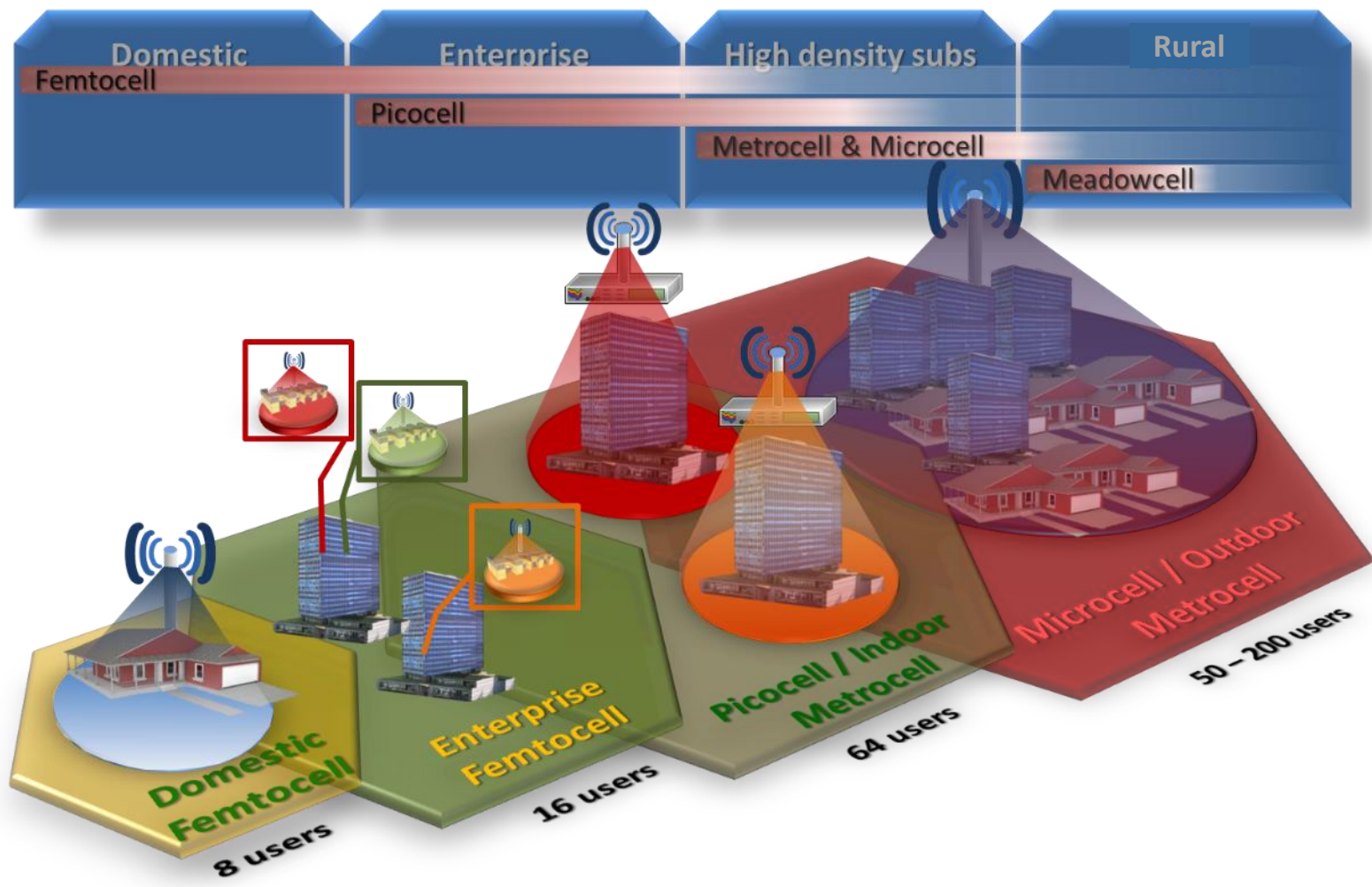


# Homogeneous Network

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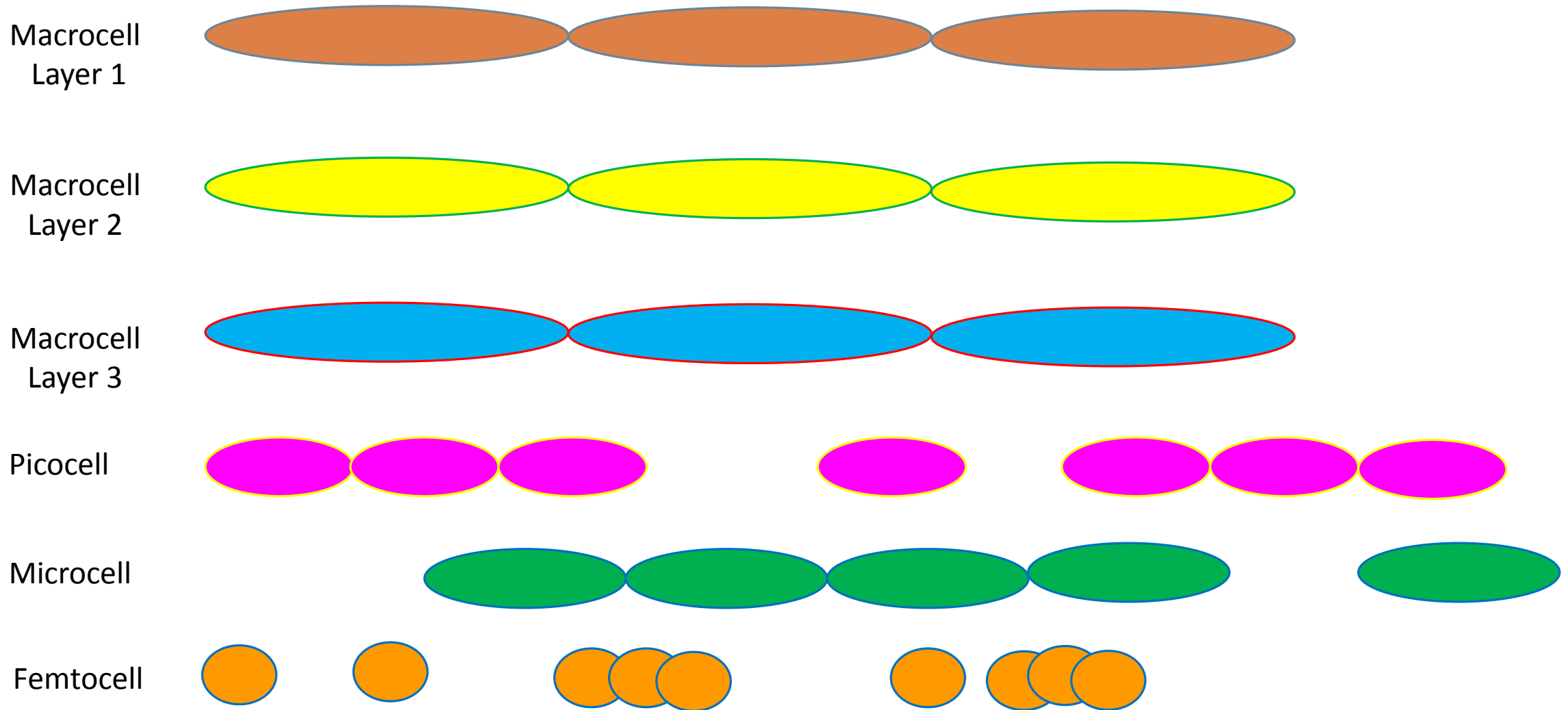


Hierarchical Cell Structures (HCS)



# Heterogeneous Network (HetNet) – Defn #1

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Source: Cisco presentation from LTEWS 2013

4G Network

3G Network

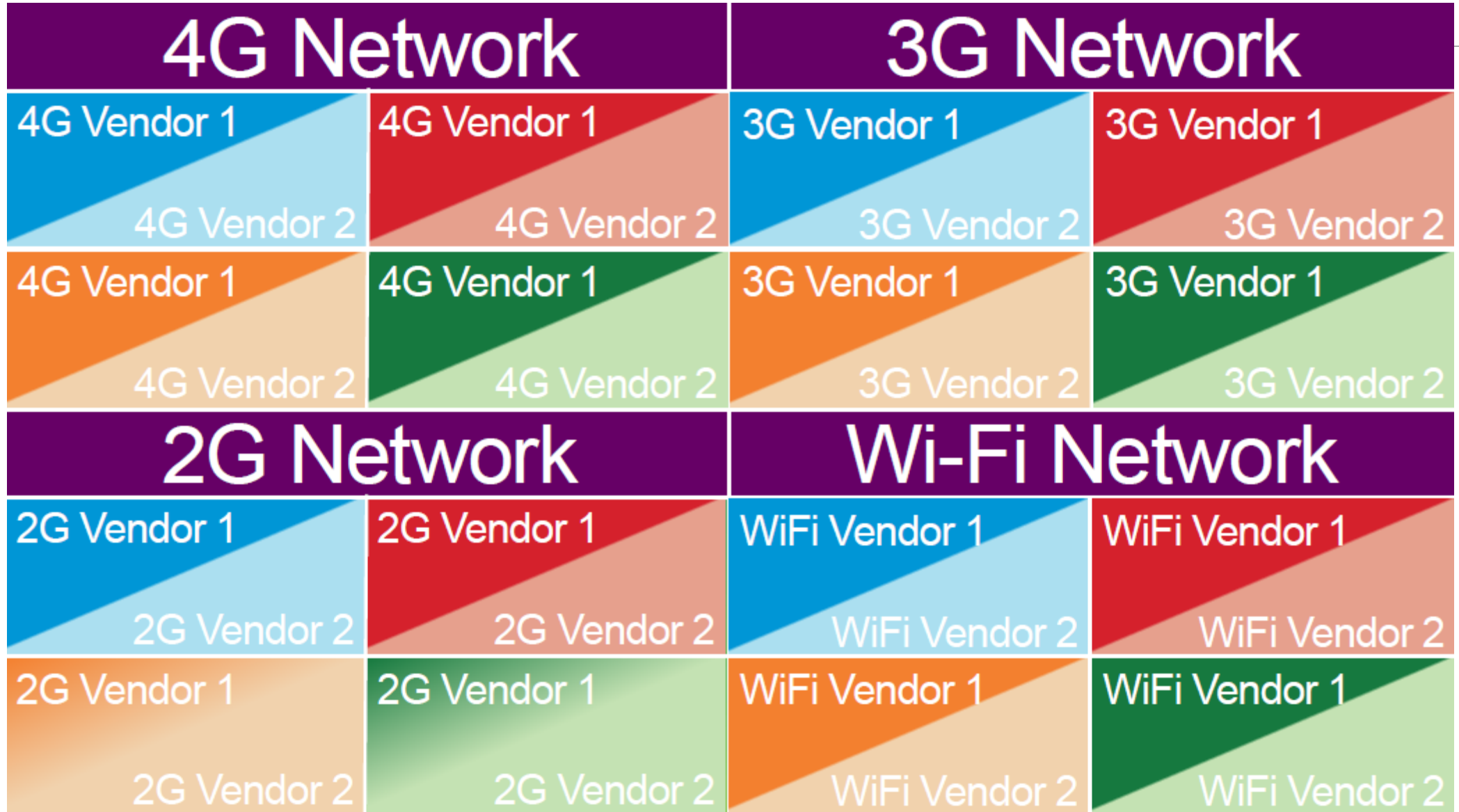
2G Network

Wi-Fi Network

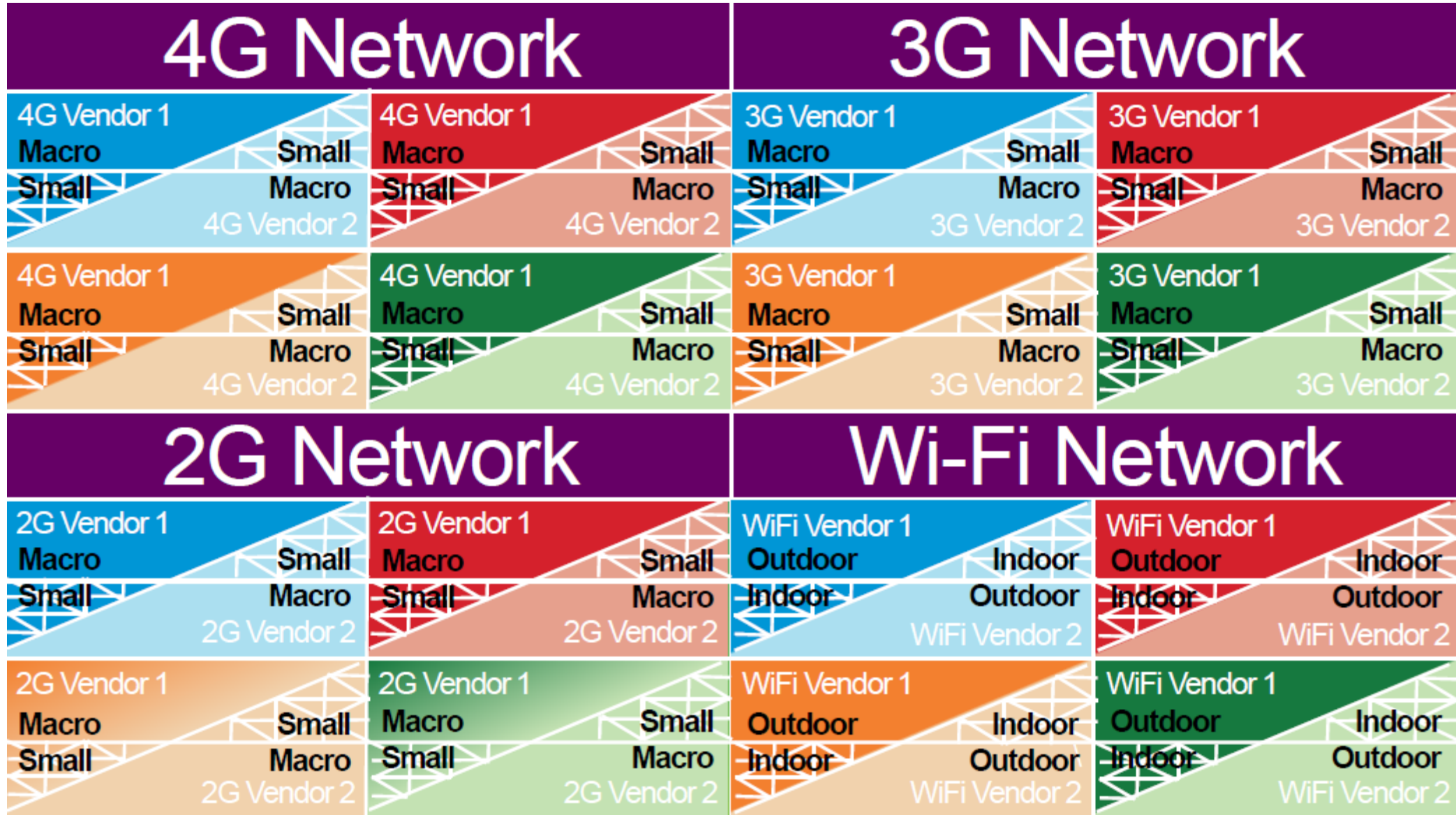
Source: Cisco presentation from LTEWS 2013

4G Network		3G Network	
4G Carrier 1	4G Carrier 2	3G Carrier 1	3G Carrier 2
4G Carrier 3	4G Carrier 4	3G Carrier 3	3G Carrier 4
2G Network		Wi-Fi Network	
2G Carrier 1	2G Carrier 2	Wi-Fi Carrier 1	Wi-Fi Carrier 2
2G Carrier 3	2G Carrier 4	Wi-Fi Carrier 3	Wi-Fi Carrier 4

# Source: Cisco presentation from LTEWS 2013

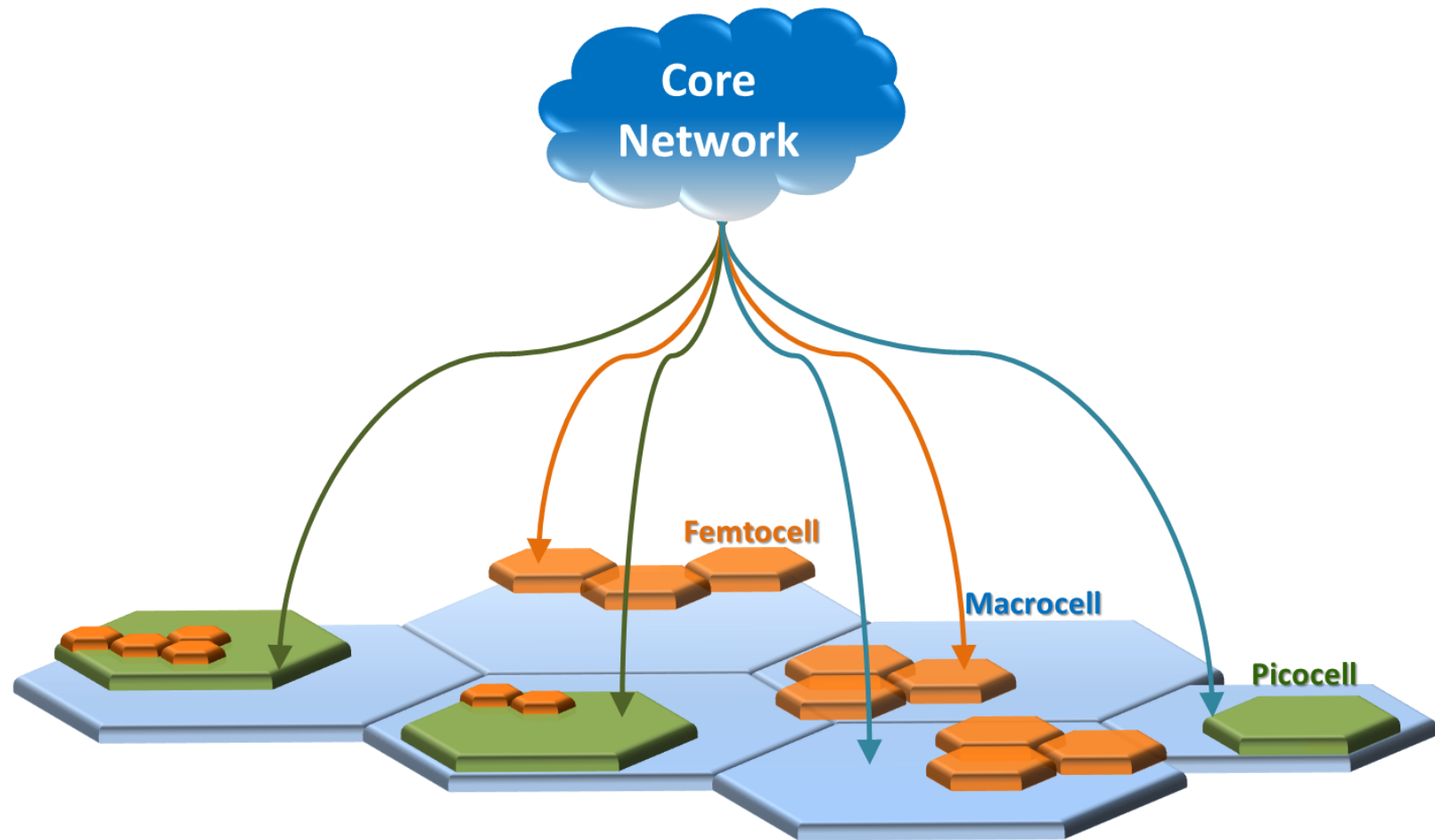


# Source: Cisco presentation from LTEWS 2013



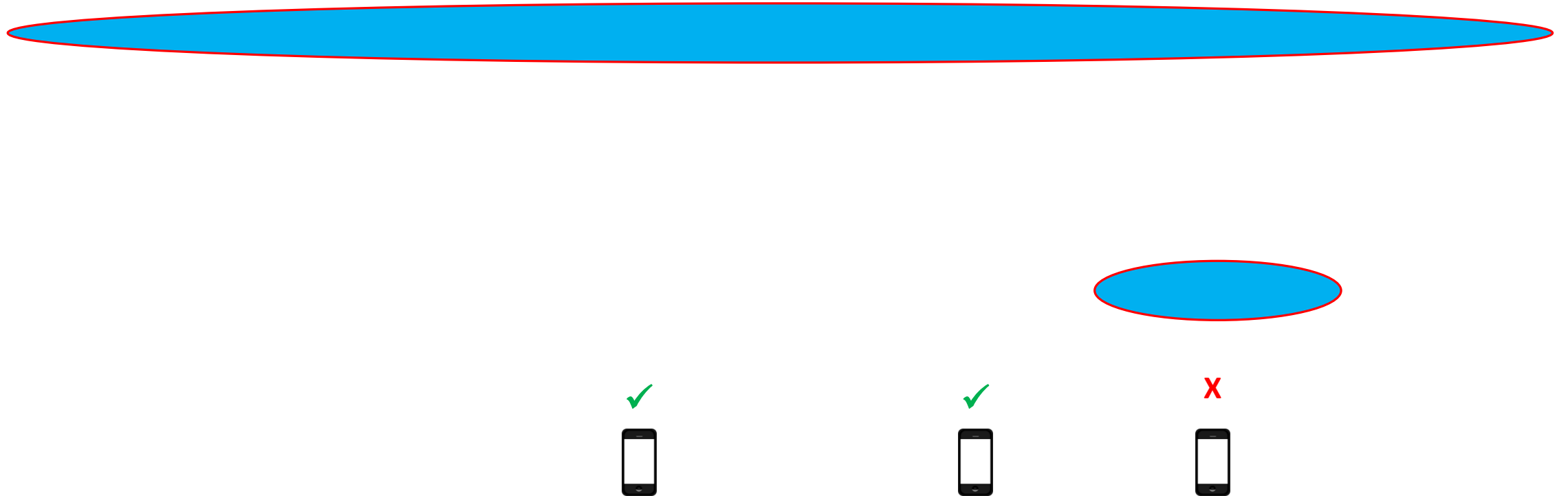
# Hierarchically Structured Network

I prefer to use this term rather than calling them HetNets. Note that in Hierarchical Cell Structures (HCS), each layer has a different frequency



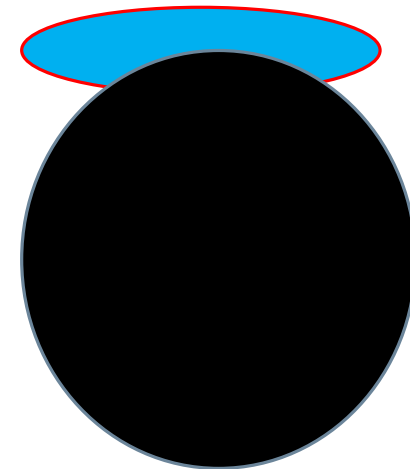
# The 'LTE' concept of HetNet

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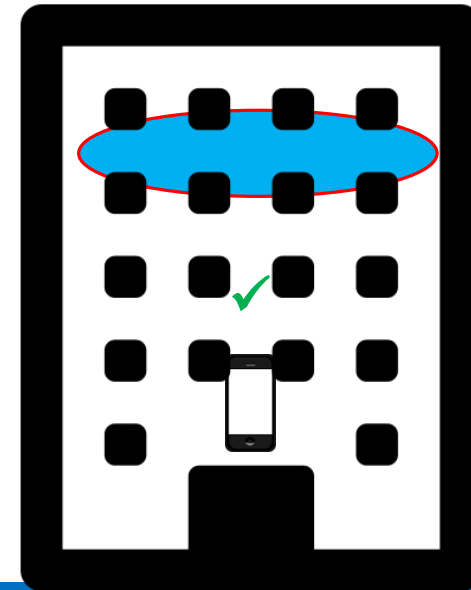
# The 'LTE' concept of HetNet

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# The 'LTE' concept of HetNet

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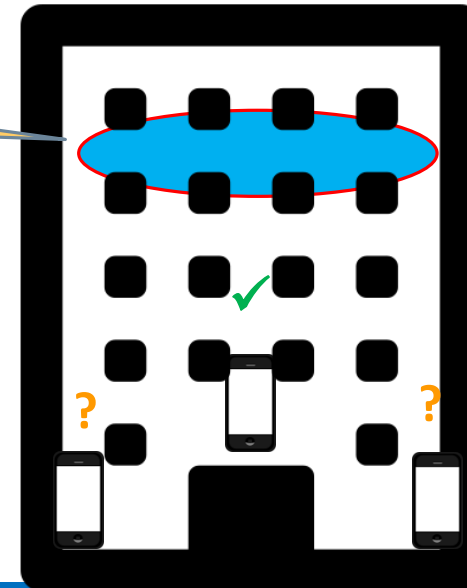


# The 'LTE' concept of HetNet

**Aggressor Cell**



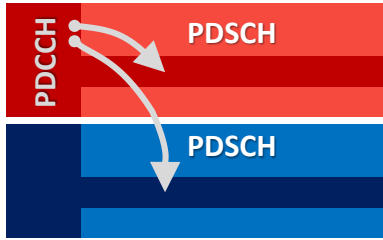
**Victim Cell**





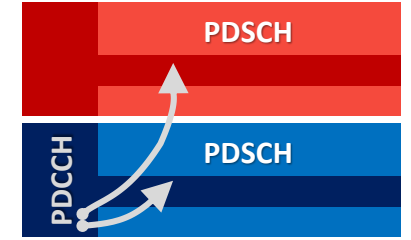
# CA based Enhanced ICIC (eICIC)

**UE #B**

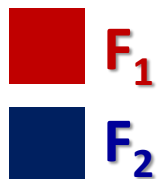
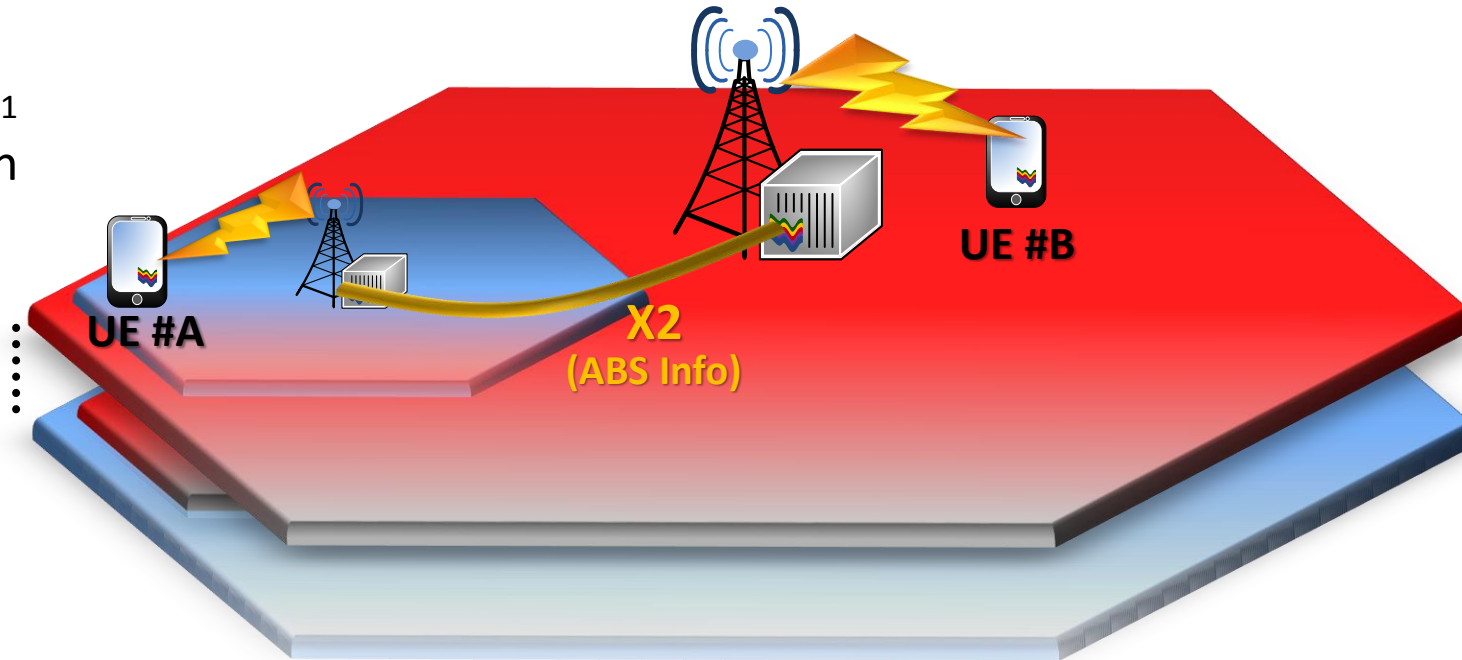


Control signal on  $F_1$   
Data signal on both

**UE #A**



Control signal on  $F_2$   
Data signal on both



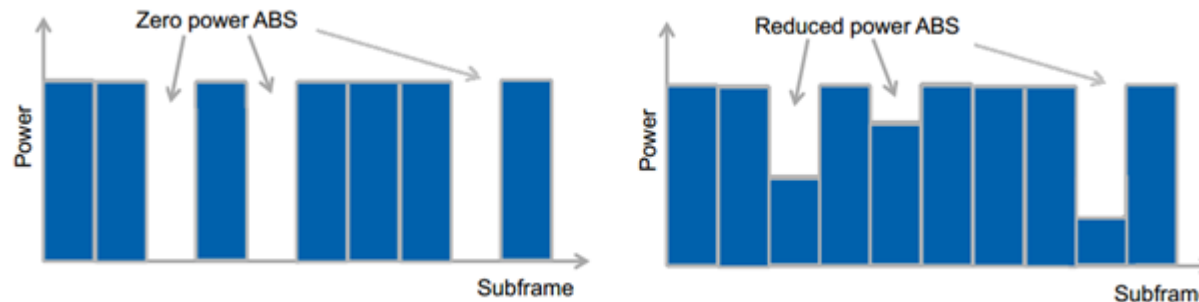
UE#A and UE#B are Cross-Carrier Scheduled (CCS)

Source: eXplanoTech

# Non-CA based Further enhanced ICIC (FeICIC)

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- At the transmitter side in DL
  - Combination of ABS + power reduction
- At the receiver side in DL
  - Use of advanced UE receiver (cancellation/discard of known signals such as CRS...)



Picture Source: Frank Royal

# References for further study

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- 3GPP: [HetNet/Small Cells](#)
- eXplanoTech: [Heterogeneous Networks \(HetNets\)](#)
- Frank Rayal: [Further Enhanced ICIC \(FeICIC\)](#)
- Netmanias: [Interference Coordination in LTE/LTE-A \(2\): eICIC \(enhanced ICIC\)](#)

Thank You

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