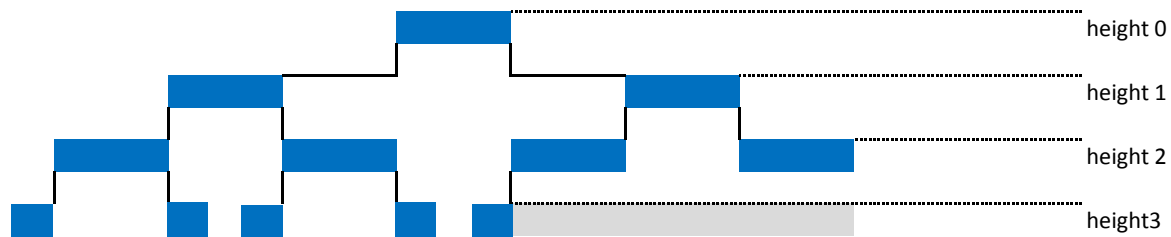


**Full binary tree of height 3**

#nodes: 15  
#leaves: 8

**height k**

#nodes:  $2^{(k+1)} - 1$   
#leaves:  $2^k$



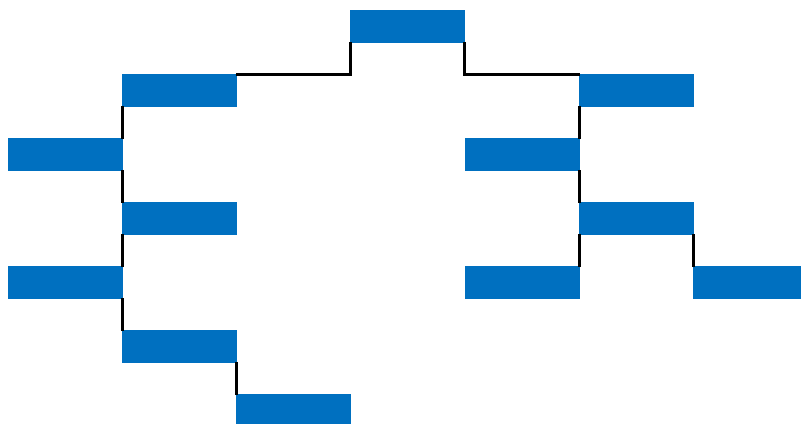
"filled left to right at max height"

"missing right leaves at max height"

**Complete binary tree of height 3**

Complete binary tree with N nodes has height of  $\text{ceil}(\log(N))$  "ceiling of  $\log(N)$ "

... that's why we usually say that the height is  $\log(N)$



**Arbitrary binary tree with N nodes**

min height:  $\text{ceil}(\log(N))$   
max height: N  
min #leaves: 1  
max #leaves:  $\leq 2^{\text{min}h}$