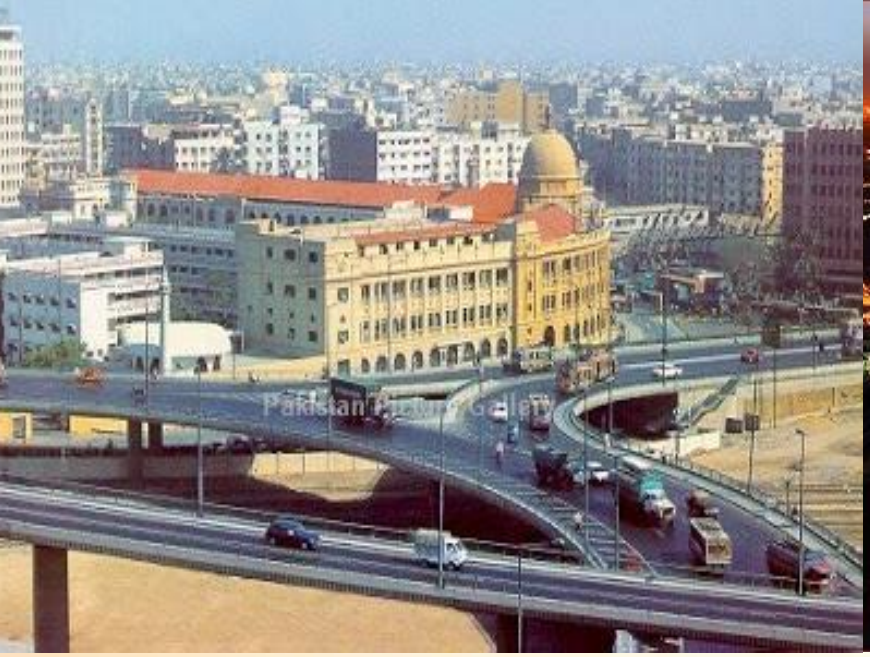
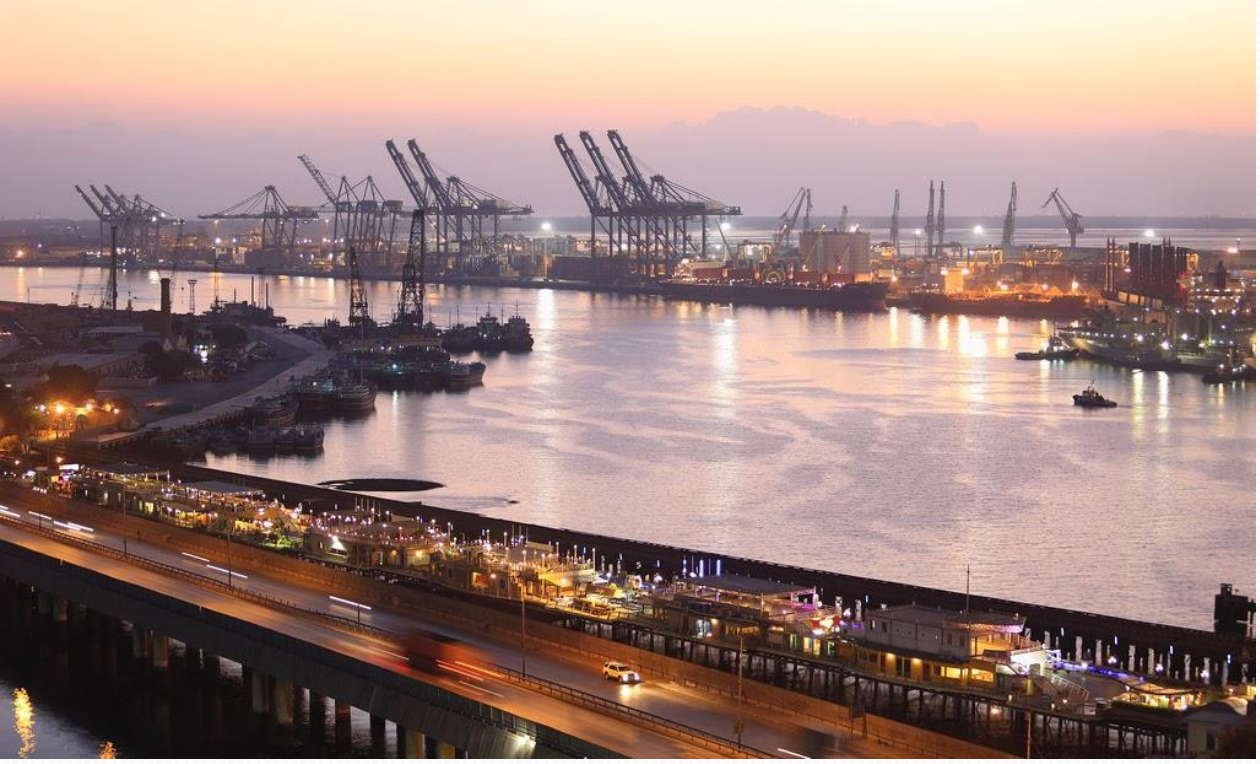
My Ongoing Journey of Experiences

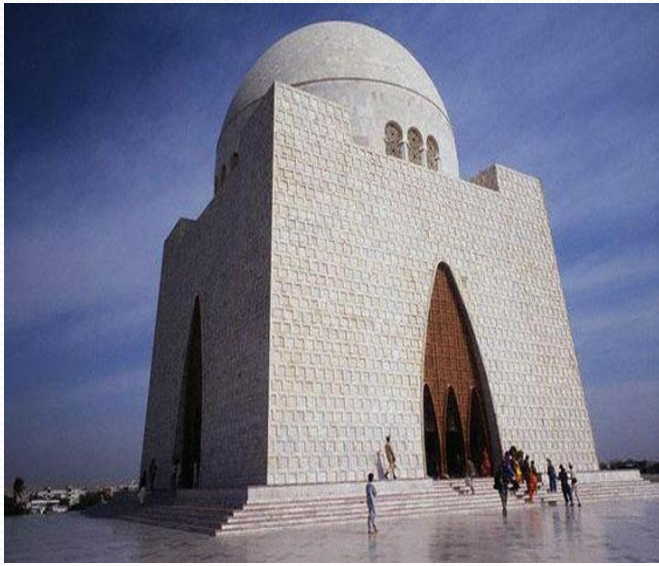
Presenter:

MSc. Zeeshan Ansar

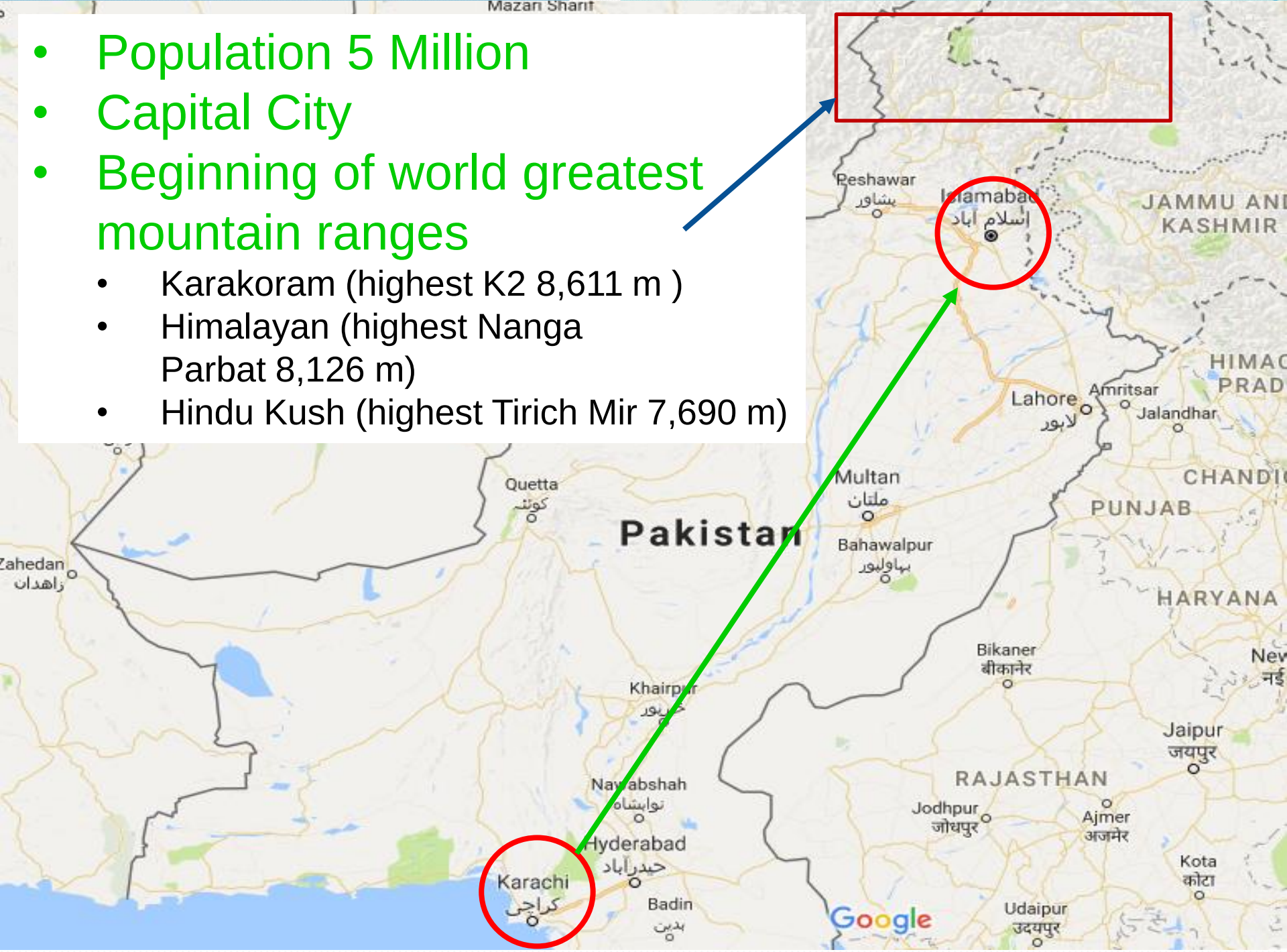
- Population 25 Million
- Largest City
- Sea Port







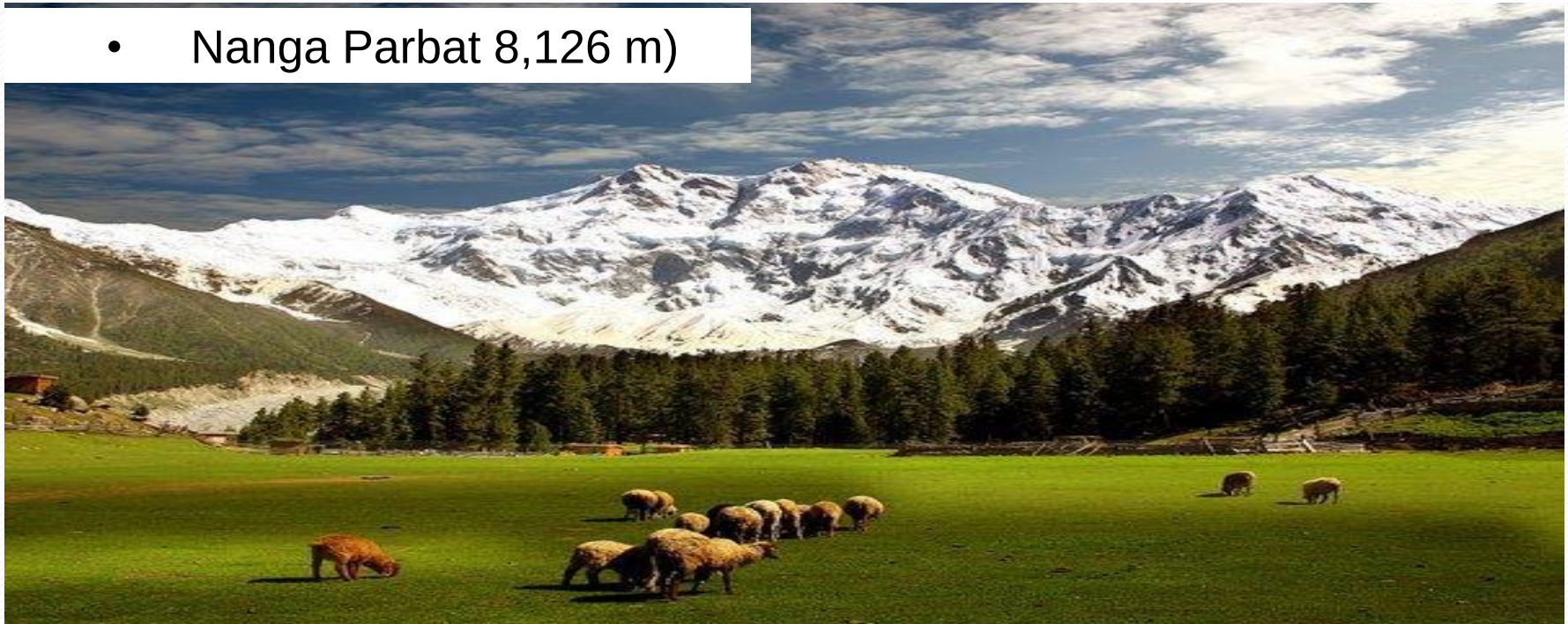
- Population 5 Million
- Capital City
- Beginning of world greatest mountain ranges



- Population 5 Million
- Capital City
- Beginning of world greatest mountain ranges
  - Karakoram (highest K2 8,611 m)
  - Himalayan (highest Nanga Parbat 8,126 m)
  - Hindu Kush (highest Tirich Mir 7,690 m)

- K2 8,611 m

- Nanga Parbat 8,126 m)



Mazari Sharif
مزار شریف
Peshawar
پشاور
Islamabad
اسلام آباد
JAMMU AND
KASHMIR
HIMAC
PRAD
کندھار
Zabol
زابل
Lahore
لاہور
Amritsar
Jalandhar
CHANDI
Quetta
کوئٹہ
Multan
ملتان
PUNJAB
Pakistan
Bahawalpur
بہاولپور
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HARYANA
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कोटा
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کراچی
Badin
بدین
Udaipur
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Google

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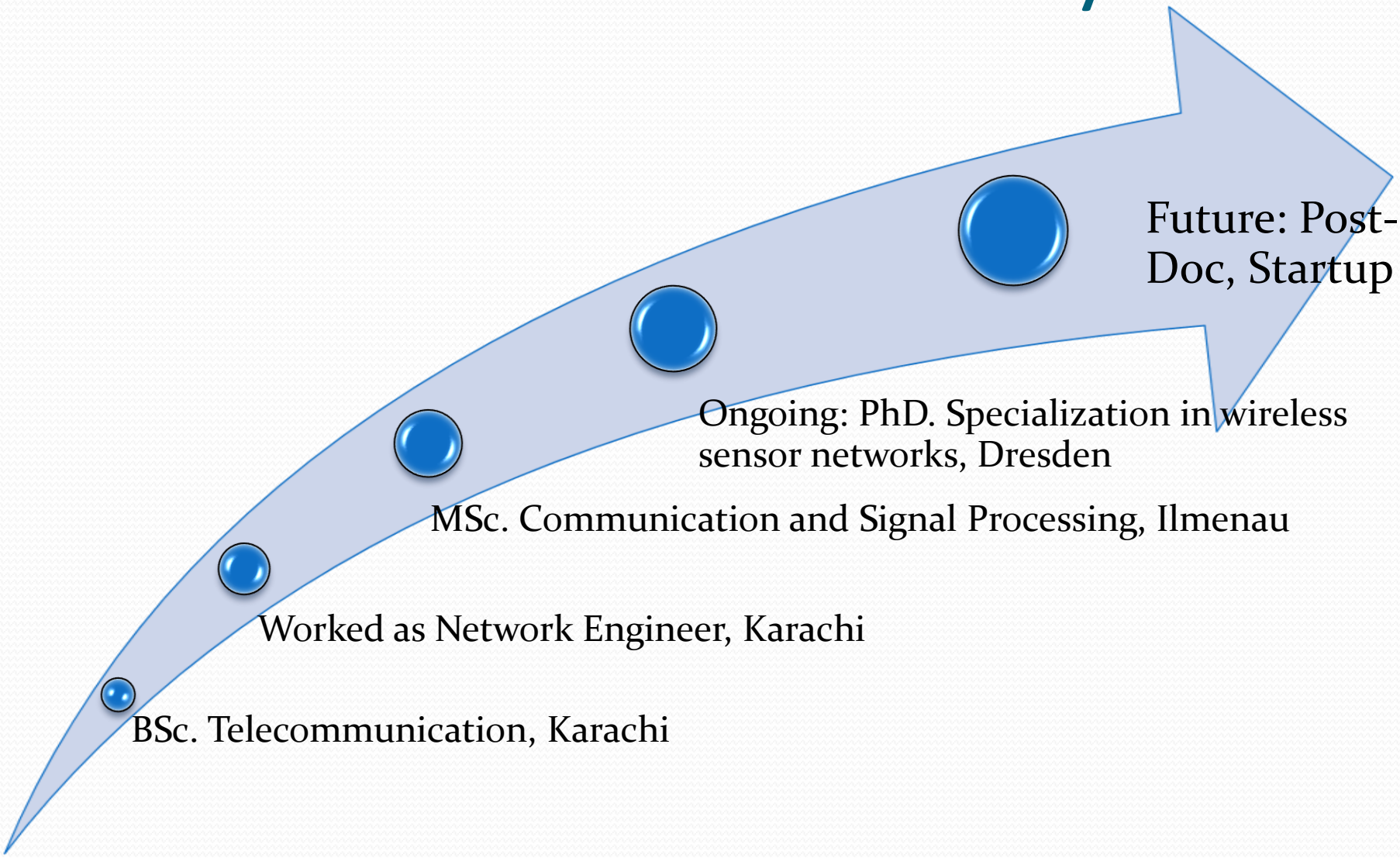
Intellectual Growth Journey



Beautiful Scenic Town

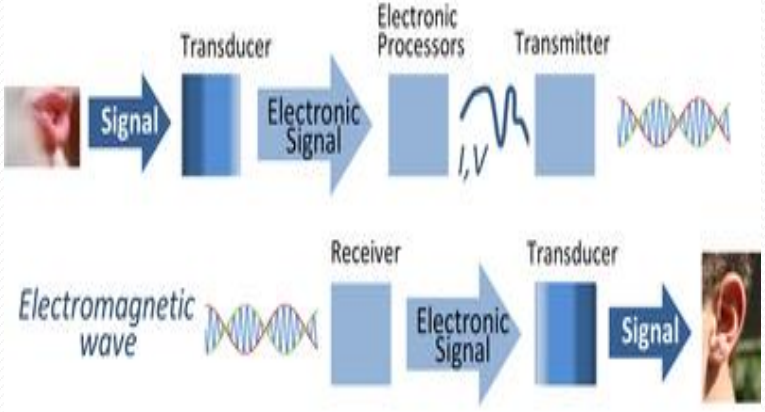
Friendly Advice

- Assignments are IMPORTANT!!
- Don’t be shy! Clarify any doubts with tutors
- For better understanding of theoretical concepts → apply it on MATLAB (e.g. SVD)
- Develop your skills while earning money → Look for HiWi
- Make new friends and enjoy every moment of this phase of life

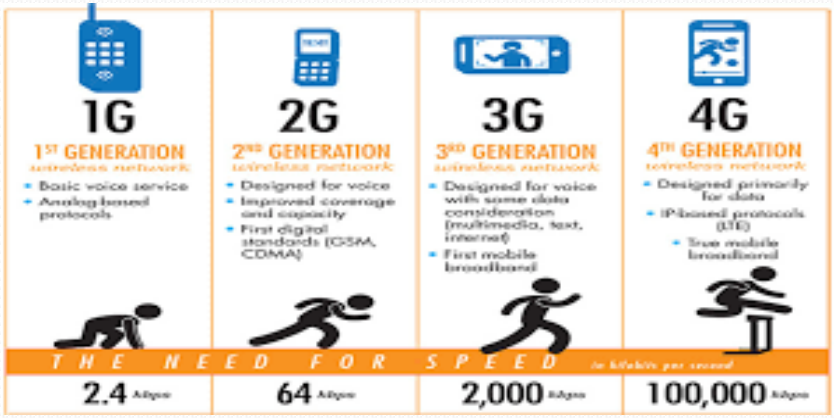
Extensive Research Prospects

Internet of things

Signal Processing



Mobile Communication

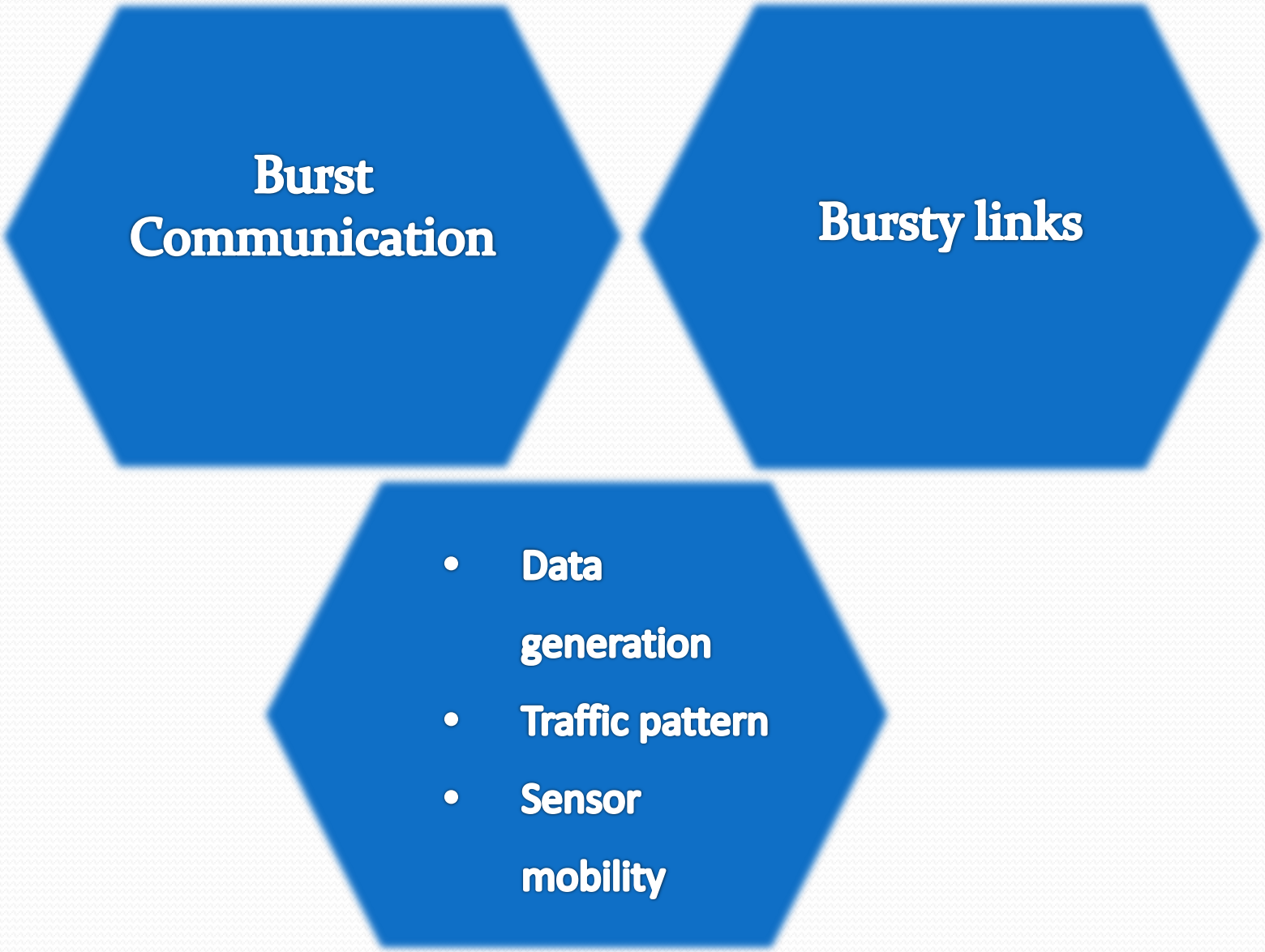


RF and Antenna Design

Current Research Topic

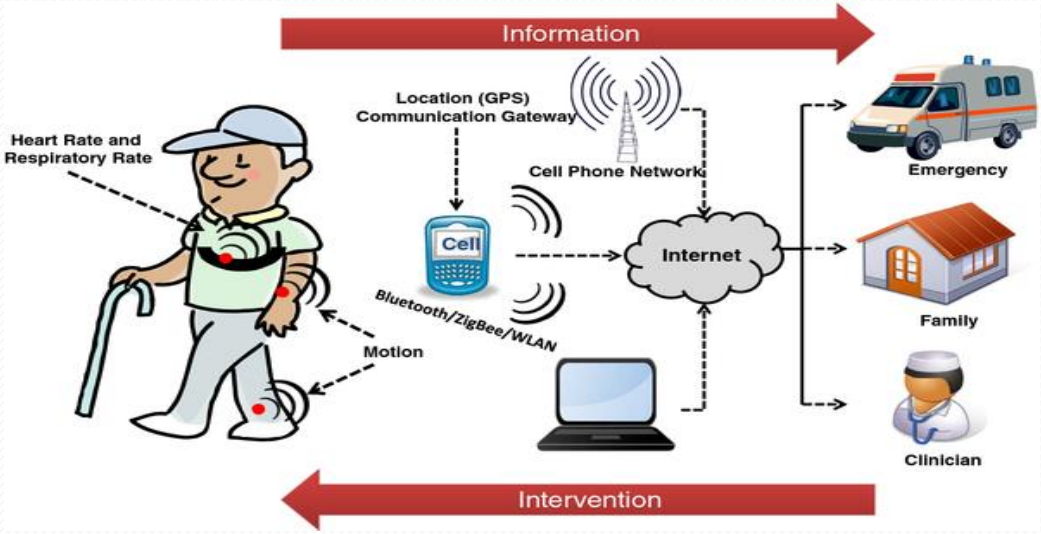
Burst Transmission Scheme for Wireless Sensor Networks

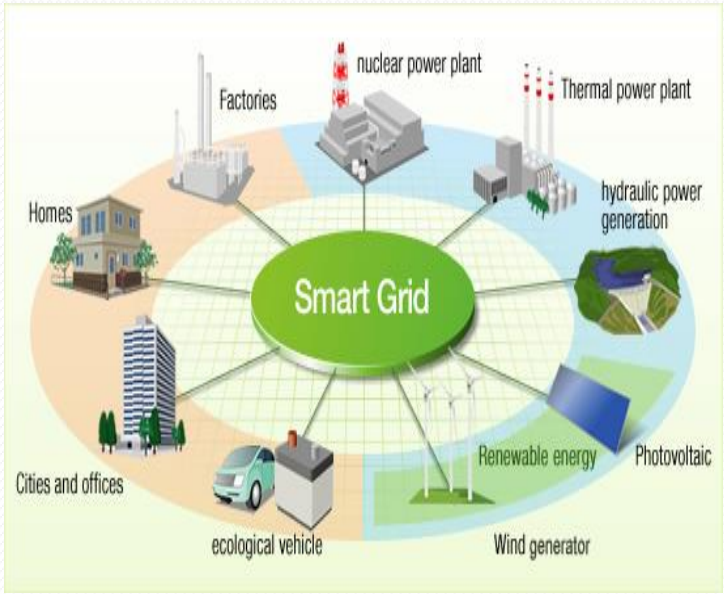
Burst Communication



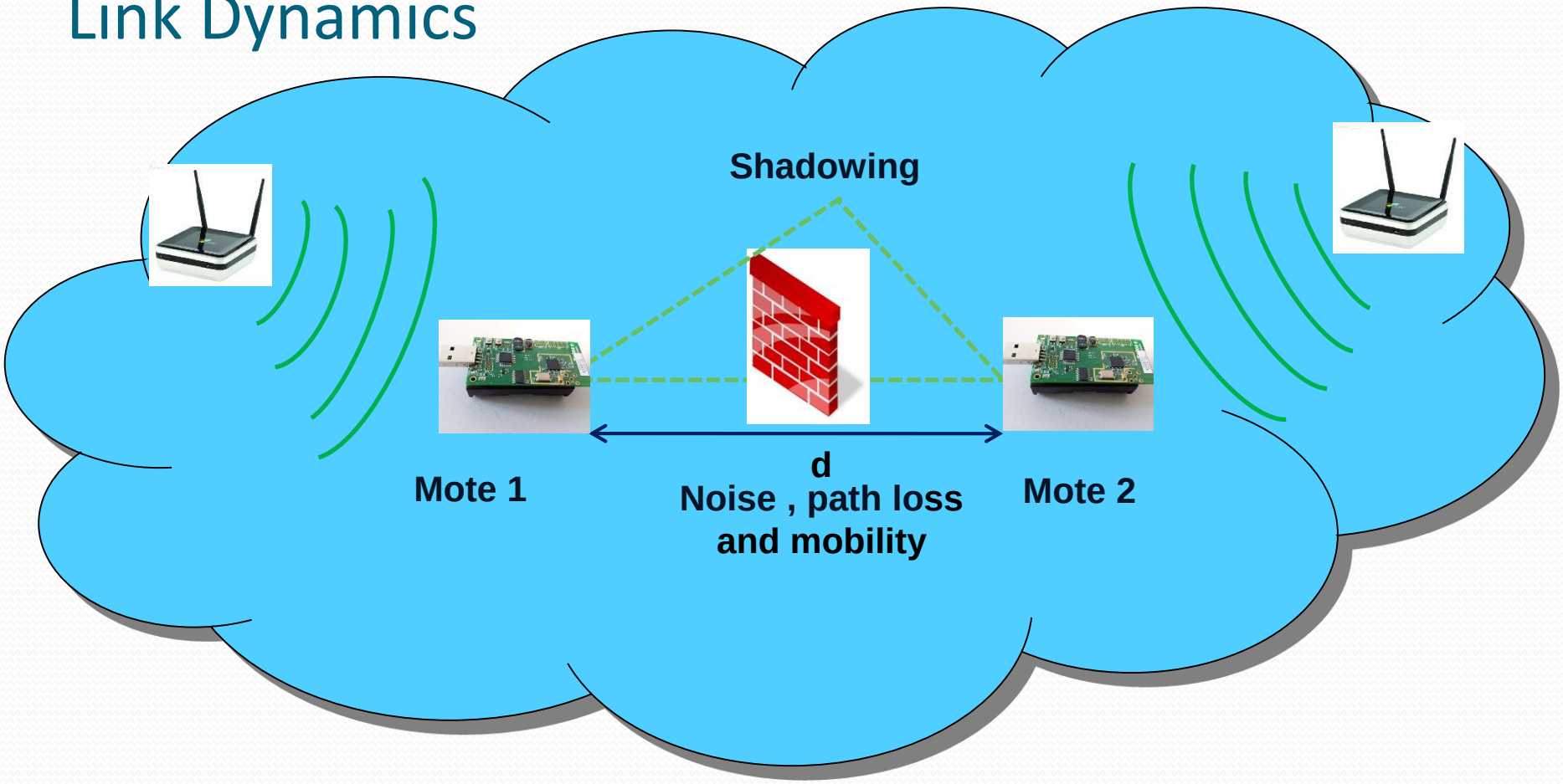
Applications

- Health-care monitoring
- Wild-life monitoring
- Environmental monitoring
- Smart grid
- Military Surveillance





Link Dynamics

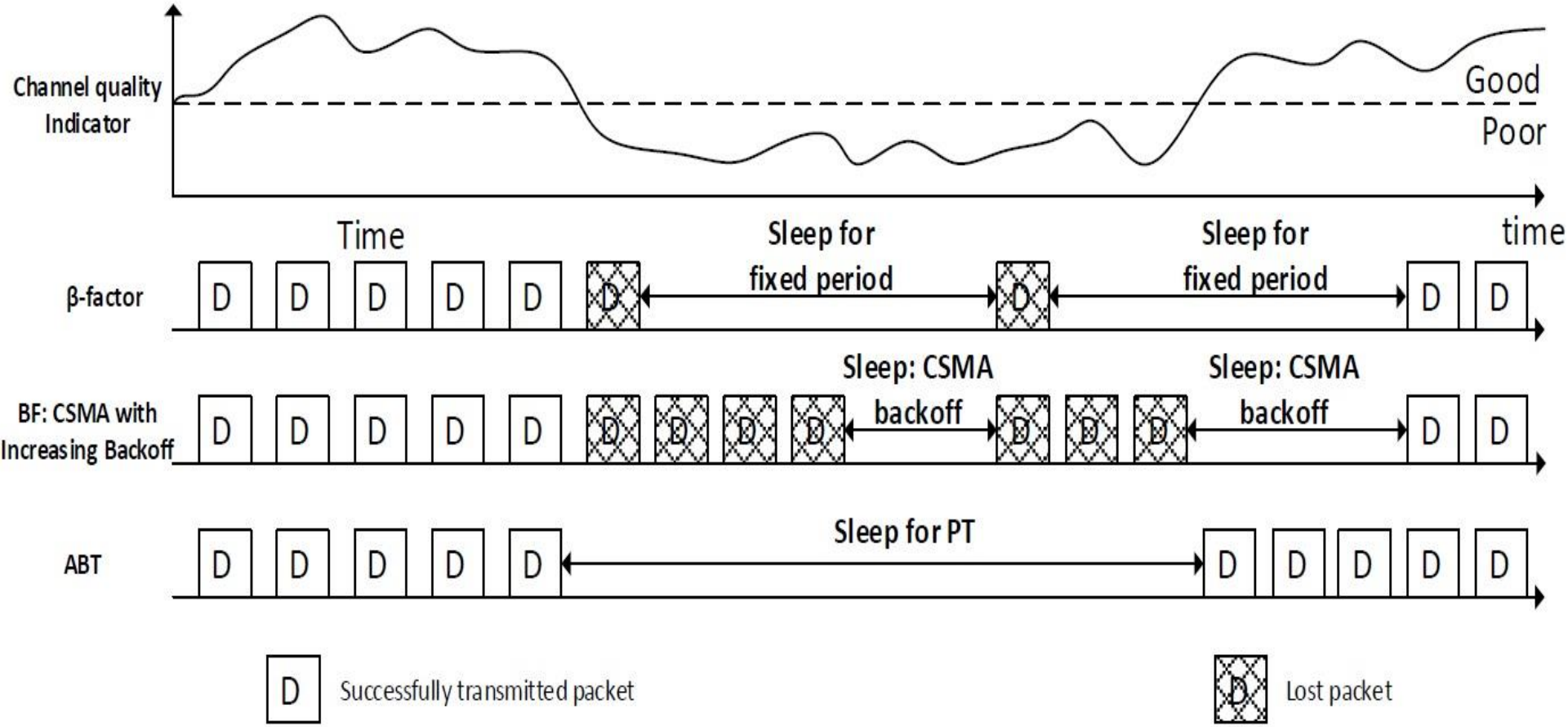


Variation in signal strength is a possible cause of link burstiness!

WHAT PROBLEM ARE WE TRYING TO SOLVE?

- Links are bursty
- Burstiness affects protocol performance
- Need a way to measure the performance
- Methods to determine the size of a burst

My Research


Channel quality Indicator
Good
Poor
Time
time
β-factor
Sleep for fixed period
Sleep for fixed period
BF: CSMA with Increasing Backoff
Sleep: CSMA backoff
Sleep: CSMA backoff
ABT
Sleep for PT
D
Successfully transmitted packet
Lost packet

Conditional Probability Base Approach (CPB)

- Conditional CDF has been proposed to describe the stable duration of link quality

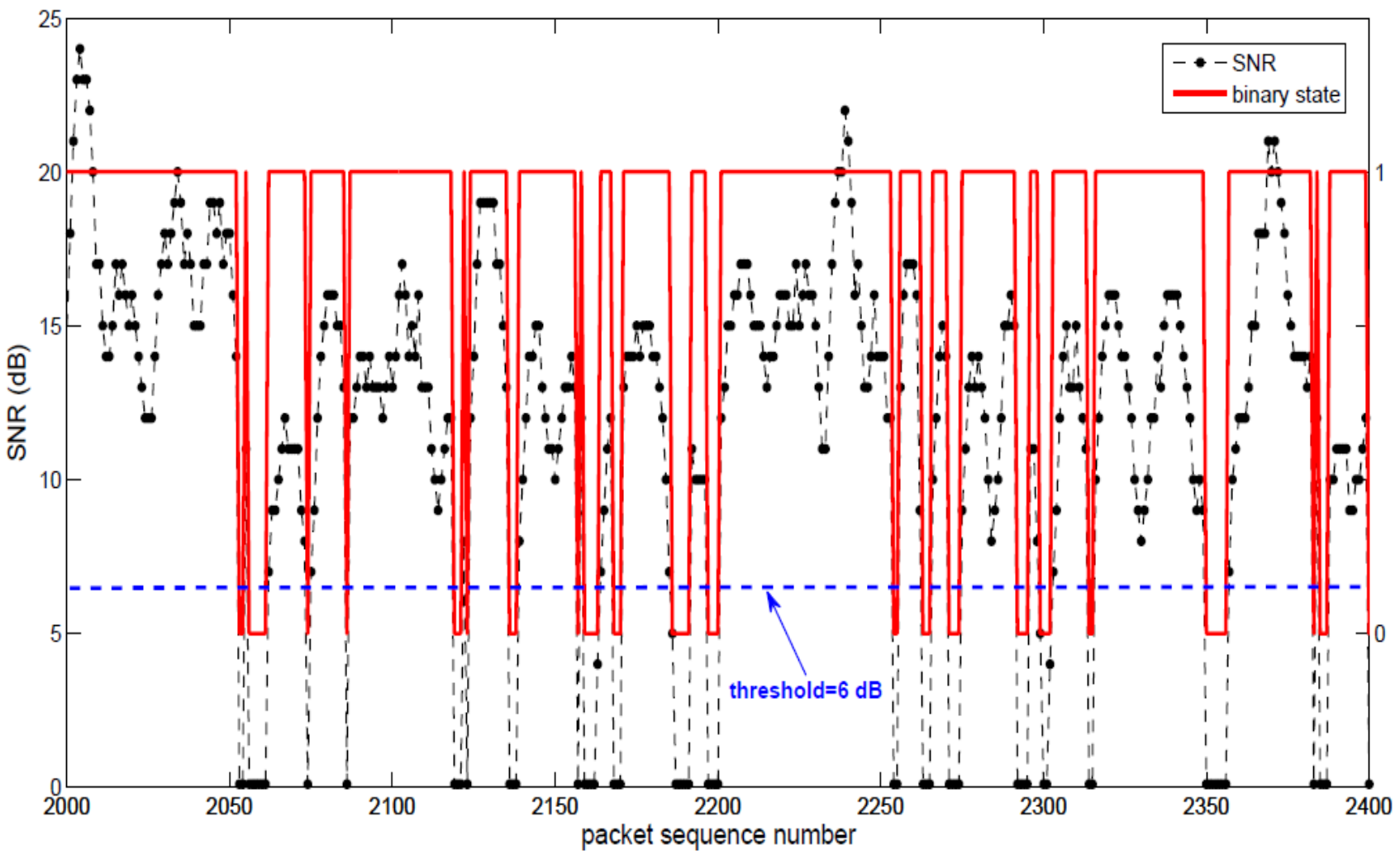
- CDF information can be utilized by MAC or application layer

- The conditional CDF of the stable duration for a given SNR is described as:

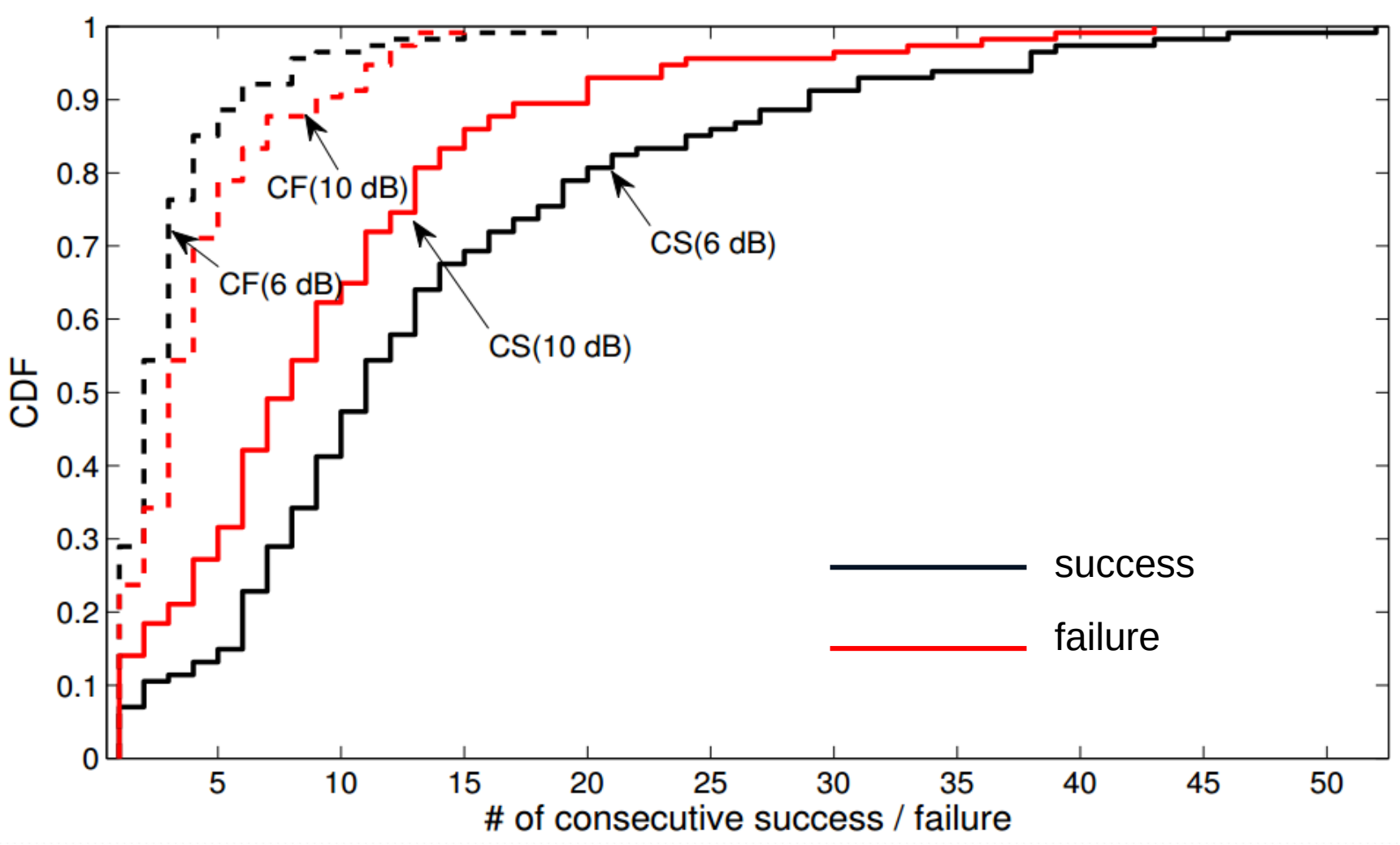
$$F(\tau|s_{th}) = P\{\mathbf{T} \leq \tau|\mathbf{s} \geq s_{th}\}$$

SNR: signal-to-noise ratio

Algorithm Design: Binary State



Algorithm Design: Empirical CDF



Conditional Probability Base Approach (CPB)

Summary: [CPB:2015]

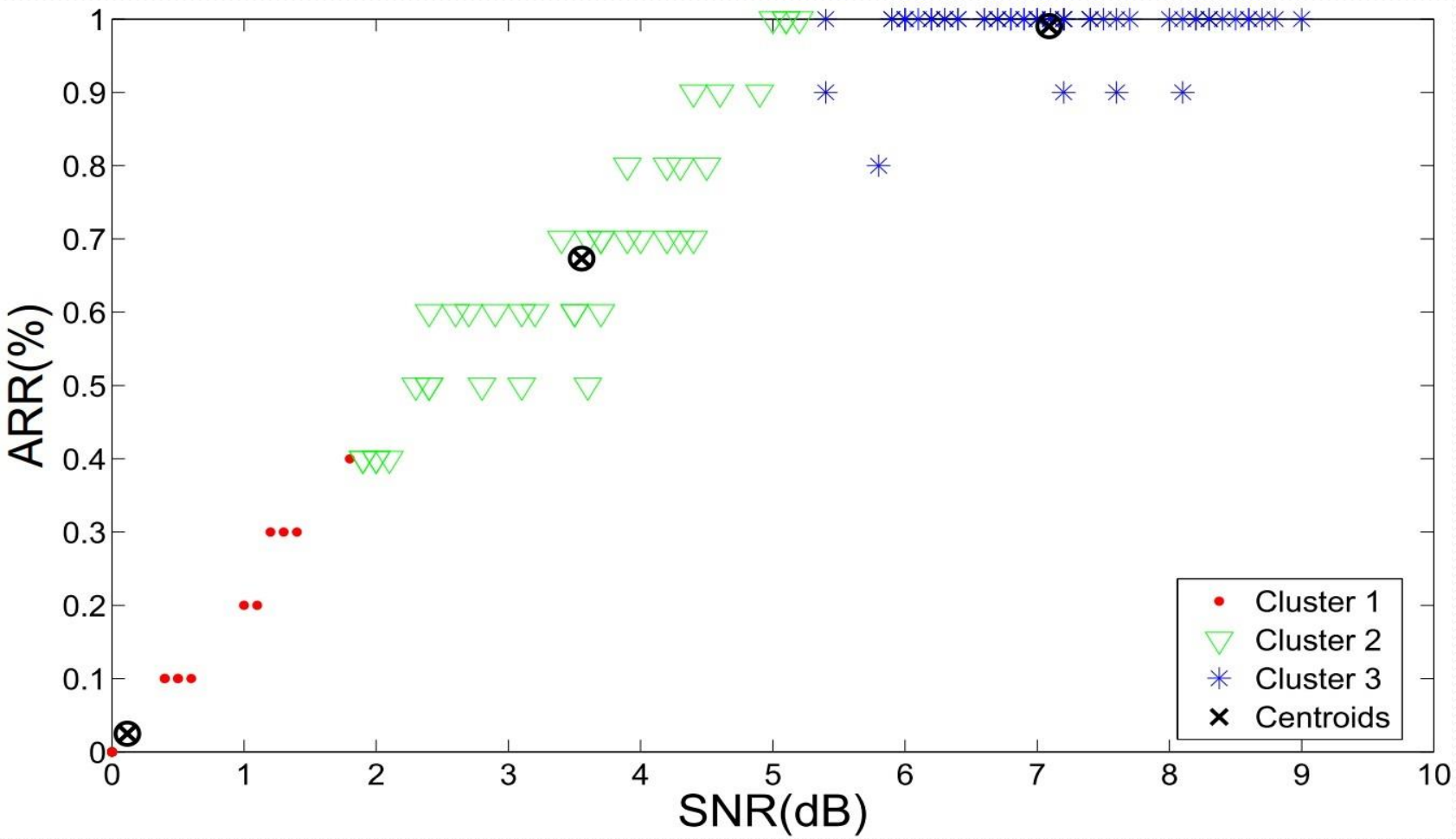
+ Conditional CDF is utilized to model the long-term link quality fluctuation.

+ Value of SNR threshold determines the reliability of data and channel efficiency

- Threshold is chosen empirically which cannot be generalized (physical links have individual aspects)

Double Markov Based Approach

K-mean clustering

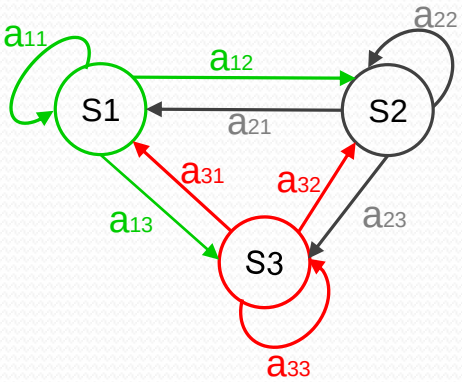


ARR: acknowledgement reception ratio

DMB

- Fluctuation in link quality is described by state transition probabilities

$$a_{ij} = P(S_j|S_i) = \frac{N_{i\to j}}{\sum_{m=1}^{M} N_{i\to m}} \longrightarrow (1)$$



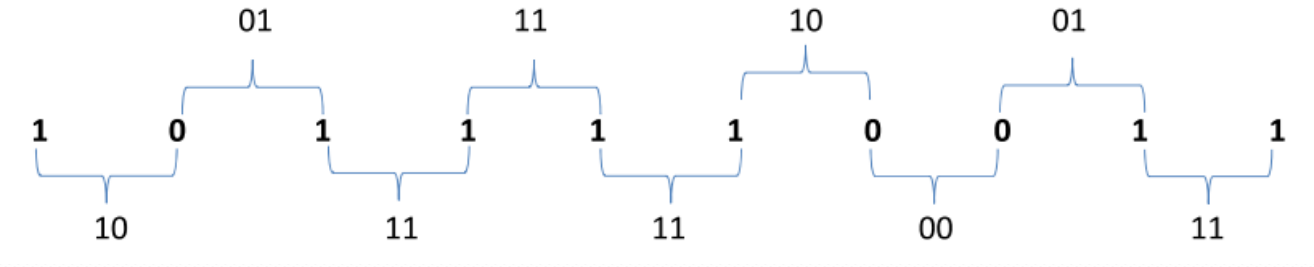
- SOJOURN Time or Expected State Duration (ESD)

$$\bar{d}_n = \sum_{d=1}^{\infty} dP_n(d) = \frac{1}{1-a_{nn}} \longrightarrow (2)$$

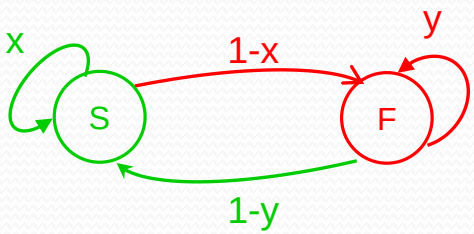
M ⟶ is the total number of states
N ⟶ is the number of transitions

DMB

- Example: Acknowledgment Sequence of State 1



- Equation (1) helps in finding state transition probabilities
- Equation (2) helps in finding out consecutive success (CS) and consecutive failure (CF)



$0 \rightarrow Failure$

$1 \rightarrow Success$

Double Markov Based Approach

Summary: [DMB:2015]

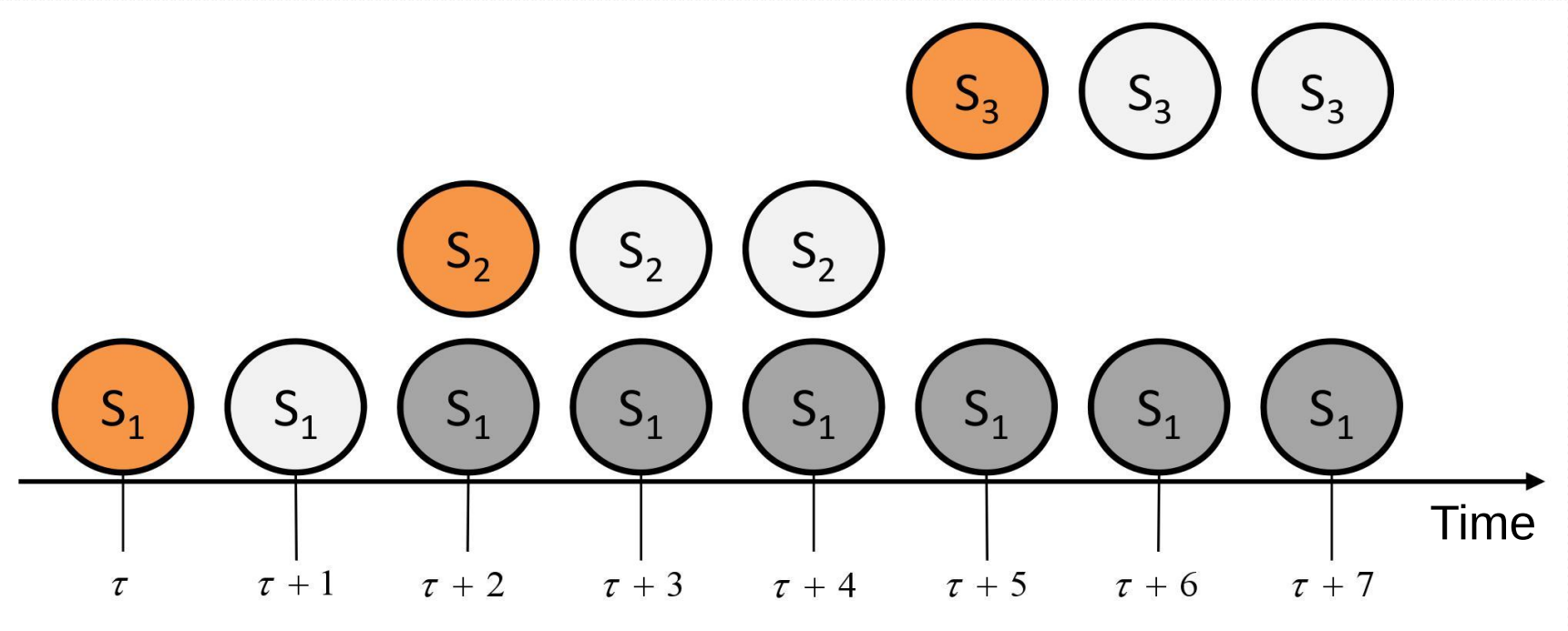
+ K-mean clustering is employed to model link quality fluctuations into countable regions

+ Furthermore, two-stage Markov model determines the stable duration and burst size

- Short-term link fluctuations are not taken into account

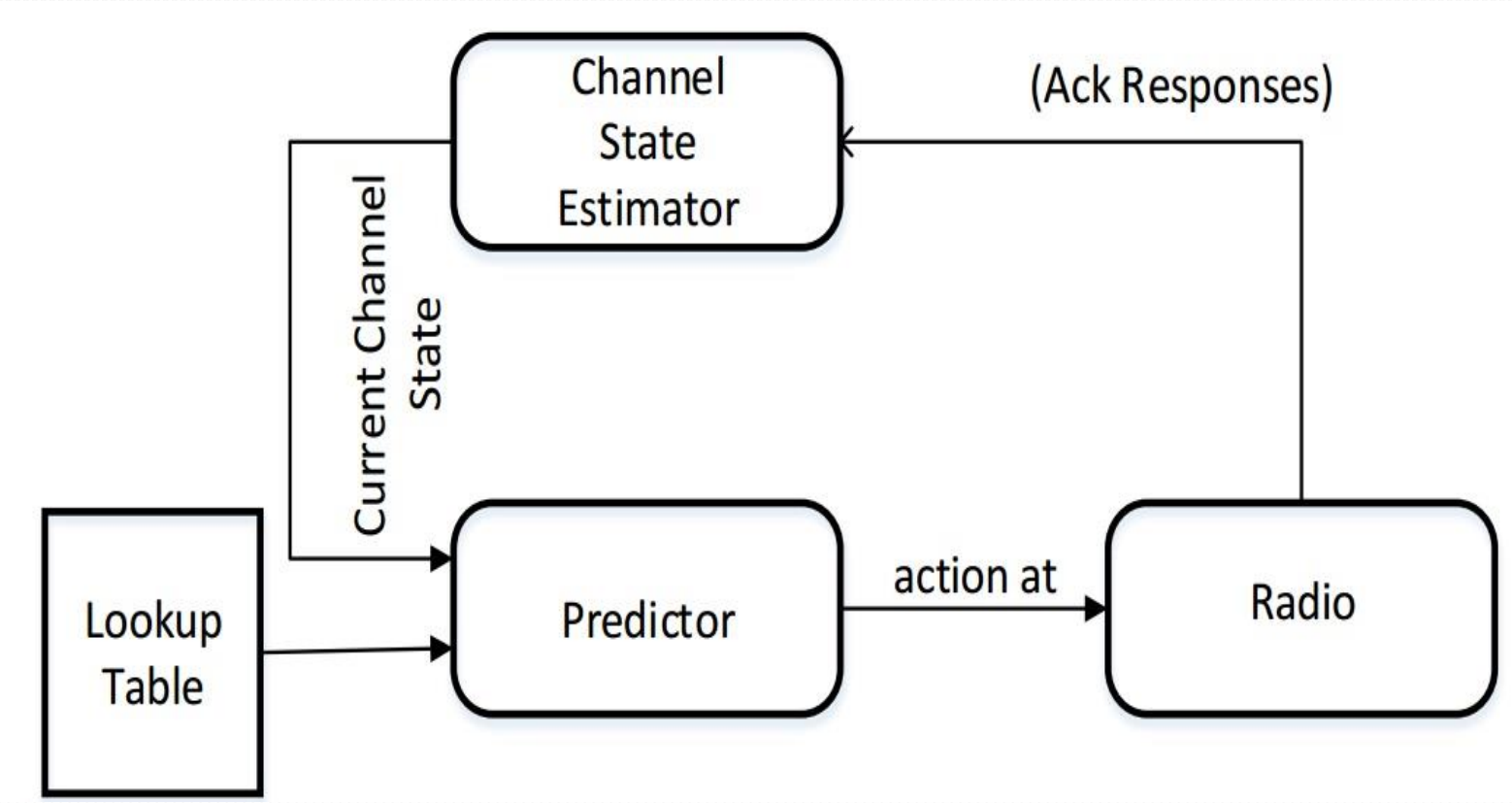
O-DMB (Online-DMB)

Short-term link fluctuation that may not be ‘Perceived by the offline model’



O-DMB

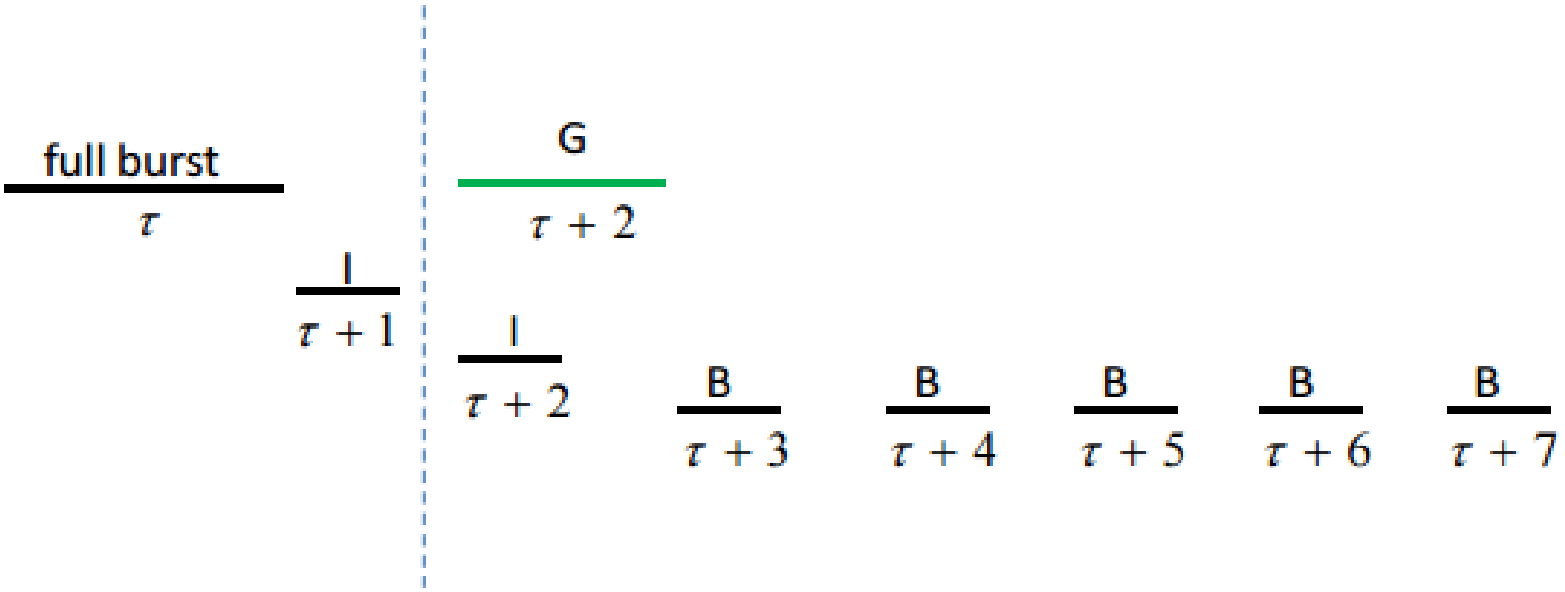
System architecture



O-DMB

Transmission Technique

Link state	Burst size	ESD
Good	10	6
Intermediate	6	4
Bad	2	8



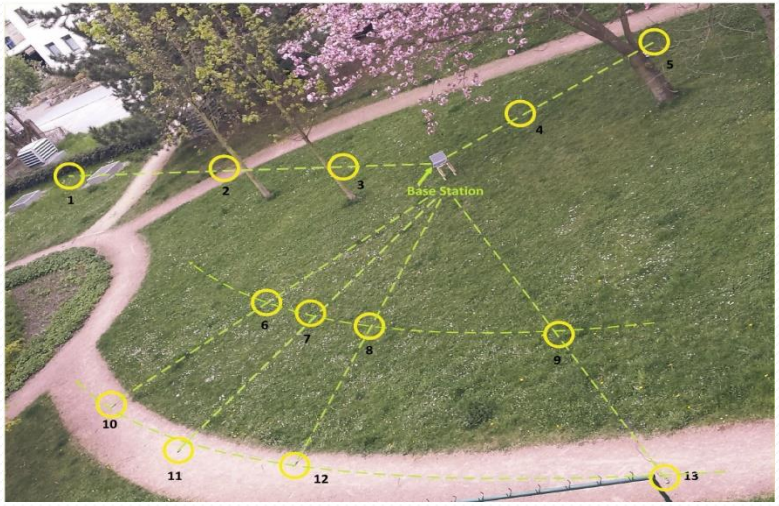
O-DMB (Online-DMB)

Summary: [O-DMB:2015]

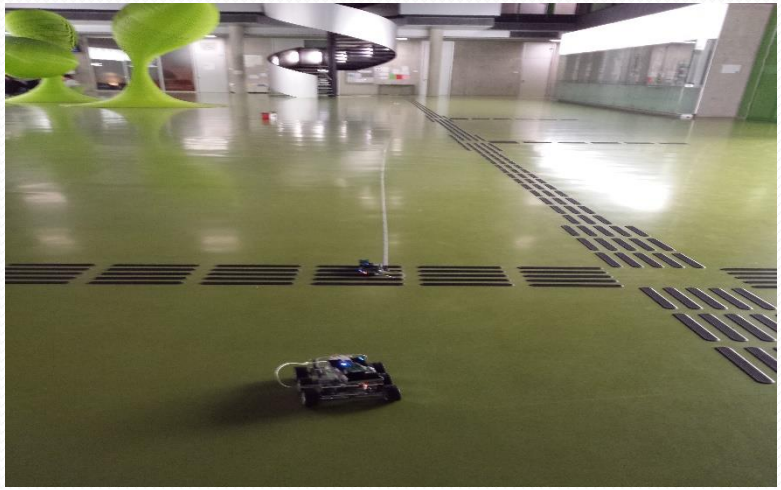
- Hybrid approach models both long-term and short-term link quality fluctuations
- Long-term link quality fluctuations can be modelled using offline approach
- Short-term link quality fluctuations can only be dealt through real-time feedback

Experiments

Outdoor



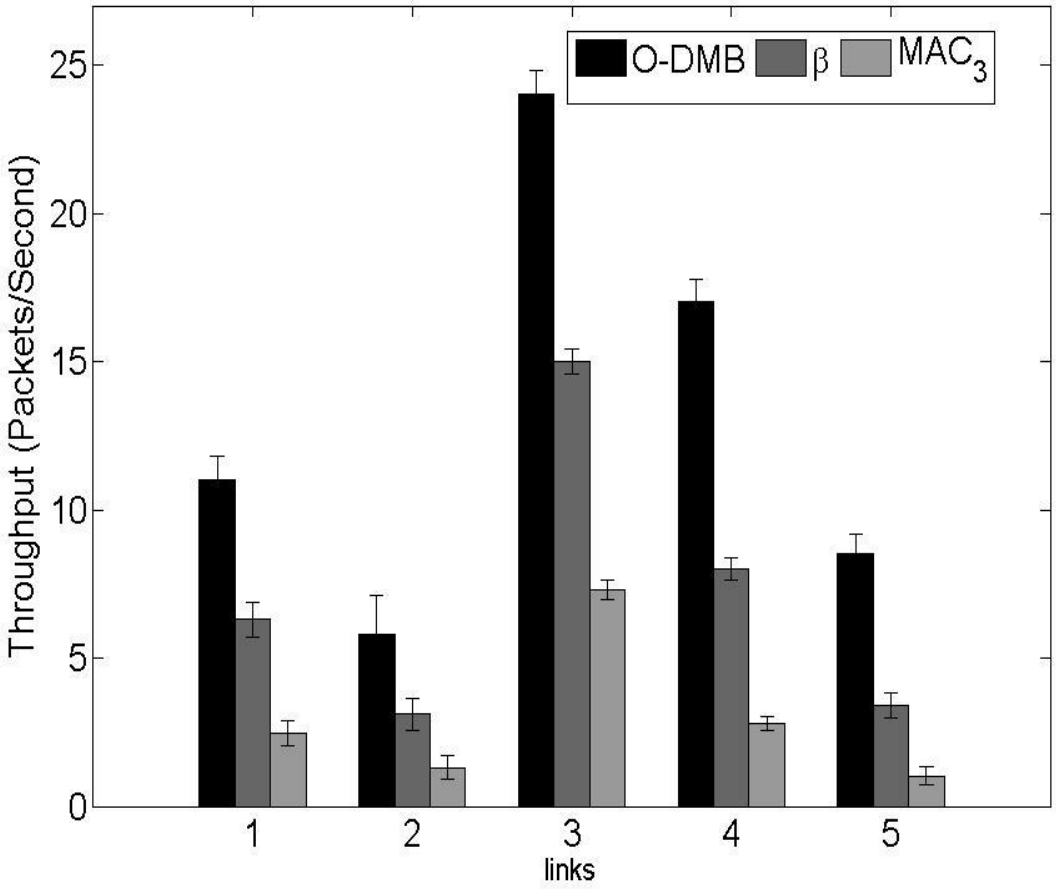
Indoor



Parameter Settings for Experiments

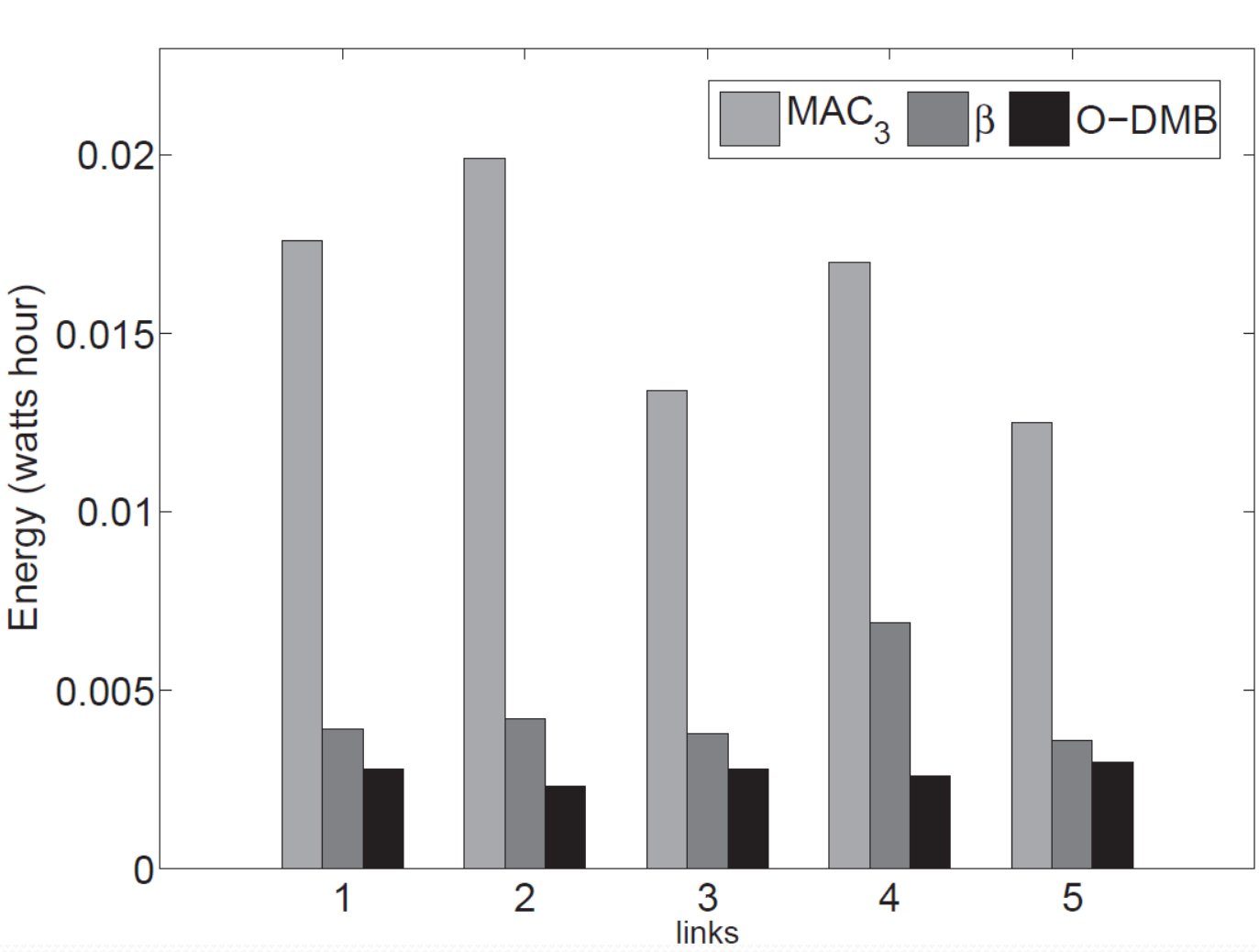
Parameters	Indoor	Outdoor
Packet Sent	120,000	120,000
Inter-Packet Interval	20,50,100 (ms)	20,50,100 (ms)
Packet Size	28 bytes	28 bytes
Transmission Power (dBm)	-15,-10,3,0	-15,-10,3,0
Distance (m)	30,20,10	35,27,19,8

Results (Static scenario)
Throughput



Results(Static scenario)

Energy



Thankyou for your attention…

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