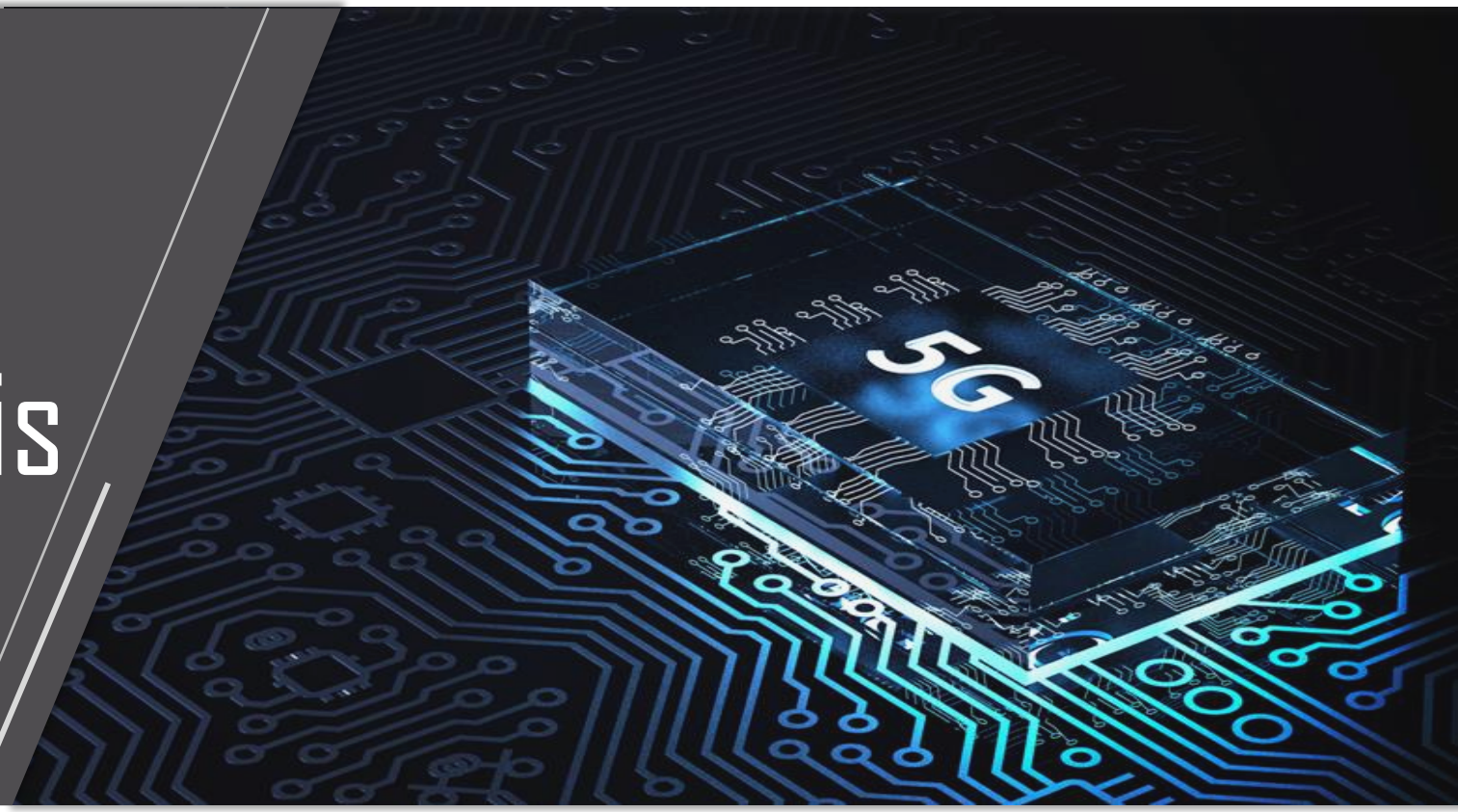
5G Telecom Patent Data Analysis

Liu Jiameng



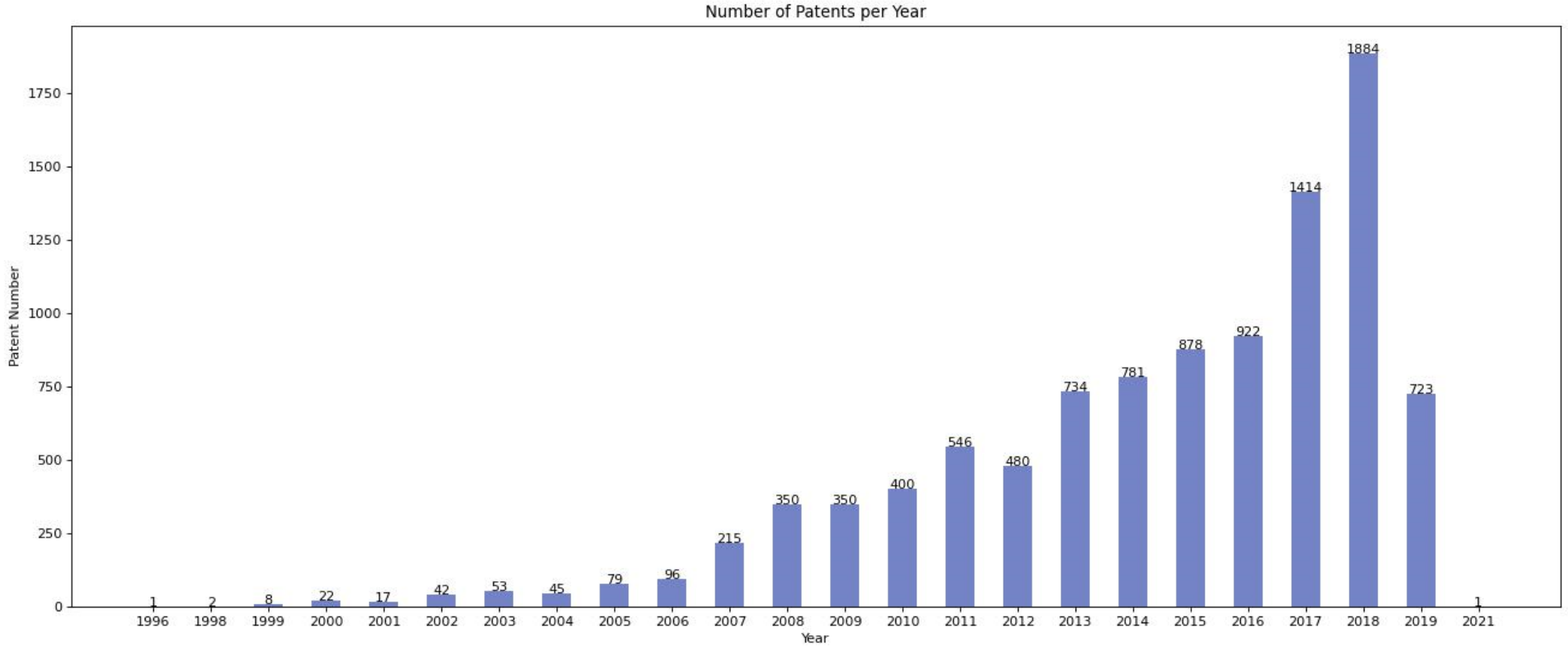
Introduction

- This report uses telecommunication dataset which covers 40 different assignees' patents from 1996 to 2021.
- This report aims at presenting an overview of patent landscape and then trying to focus on a specific company Huawei.
- Due to the time lag between patent application and patent approval, further analysis does not include the data after 2018.

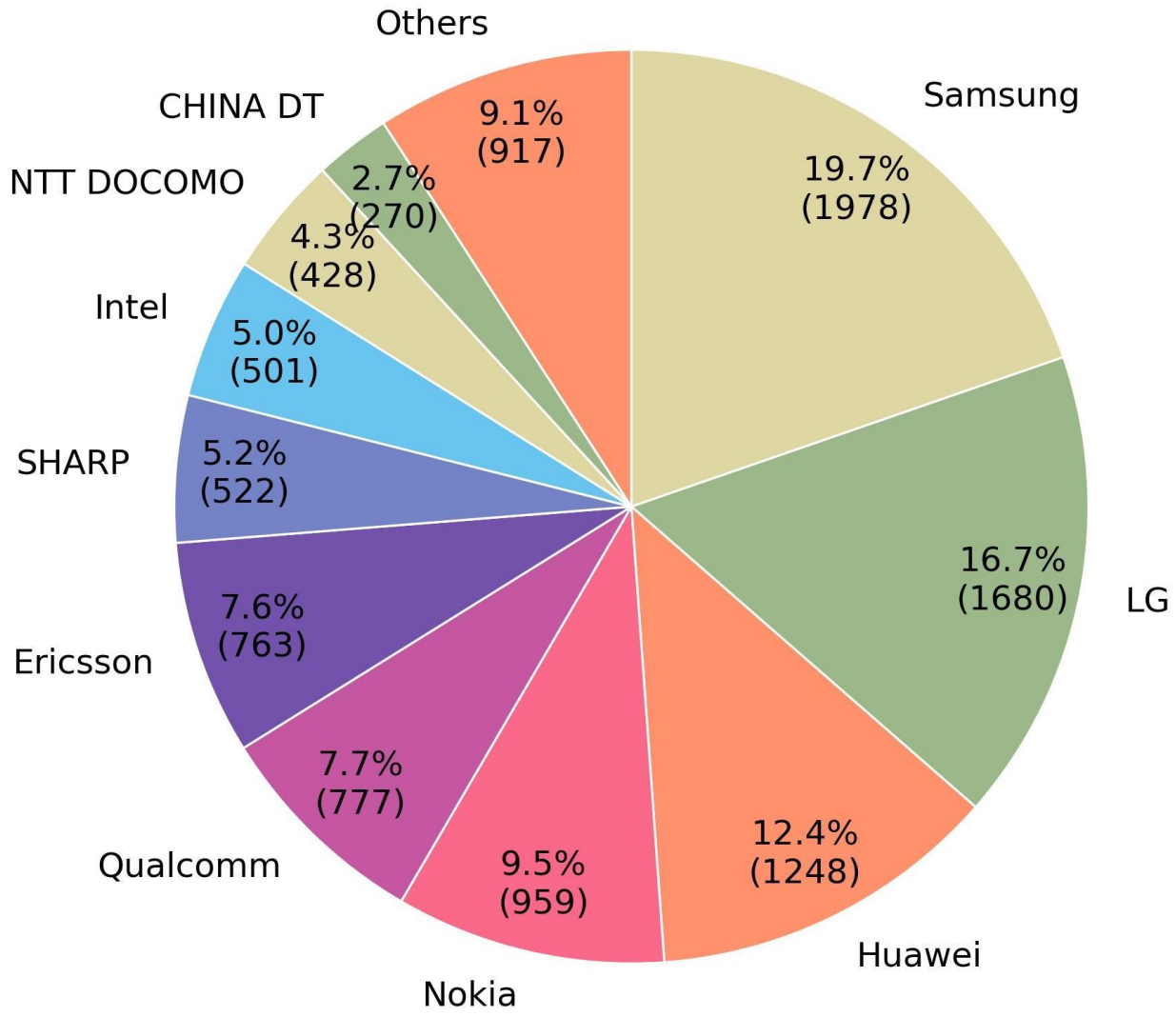
CONTENTS

Data Overview 01

Number of Patents Per Year



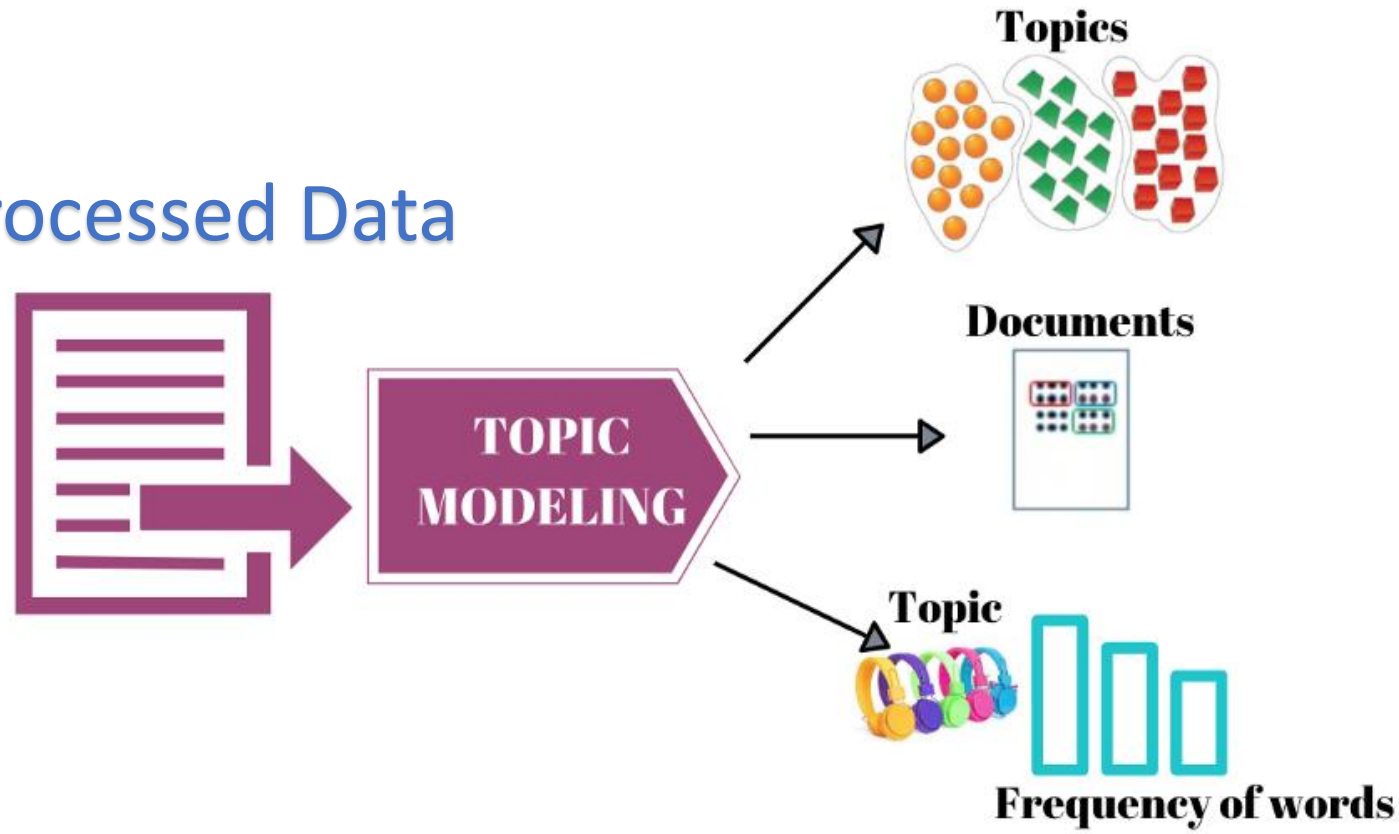
Companies 'Contribution



Methodology 02

Methodology

Preprocessed Data

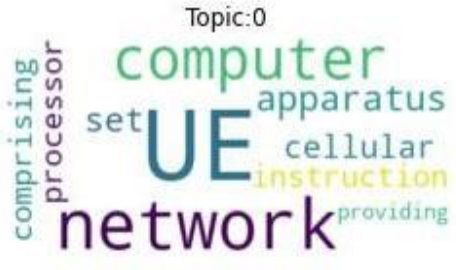


LDA

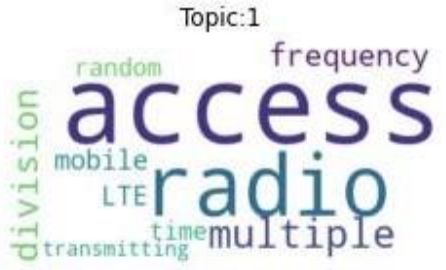
Technology Topics 03

Word Clouds

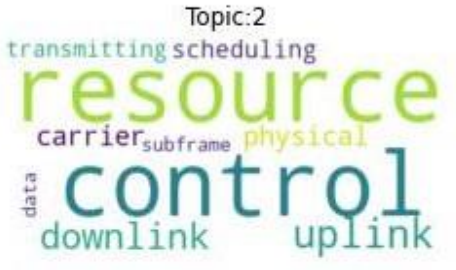
User Equipment



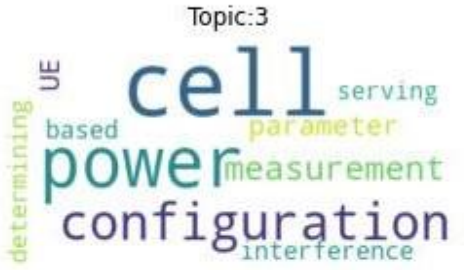
Multiple Radio Access



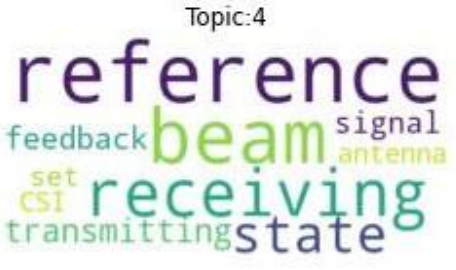
Carrier Aggregation



Cell Power

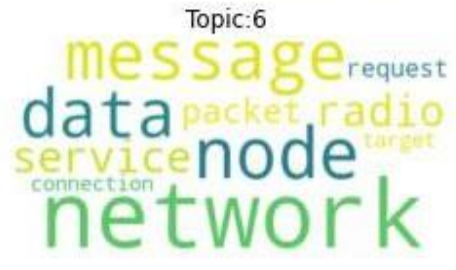


Beamforming

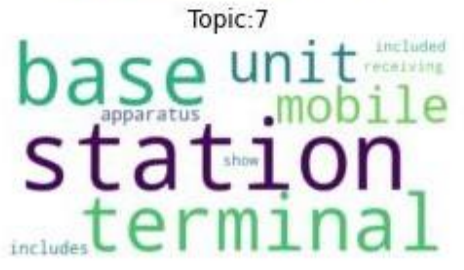


Block Coding

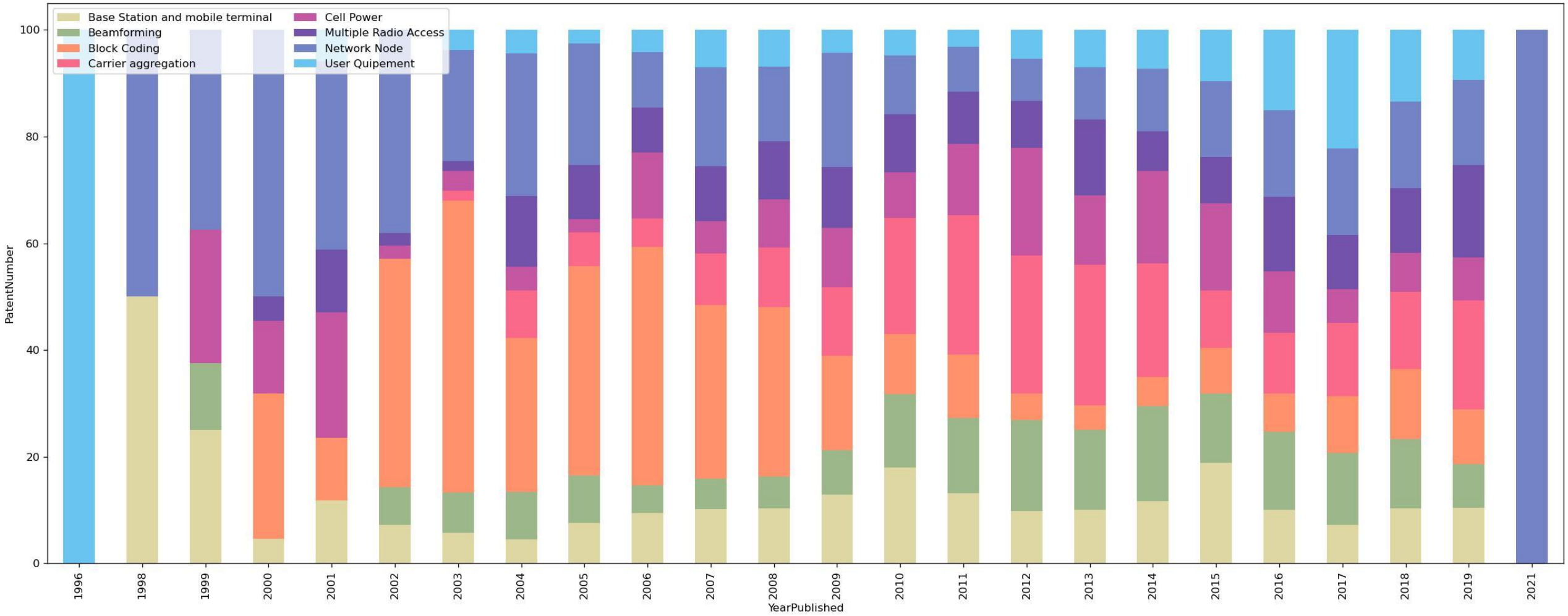
Network Node



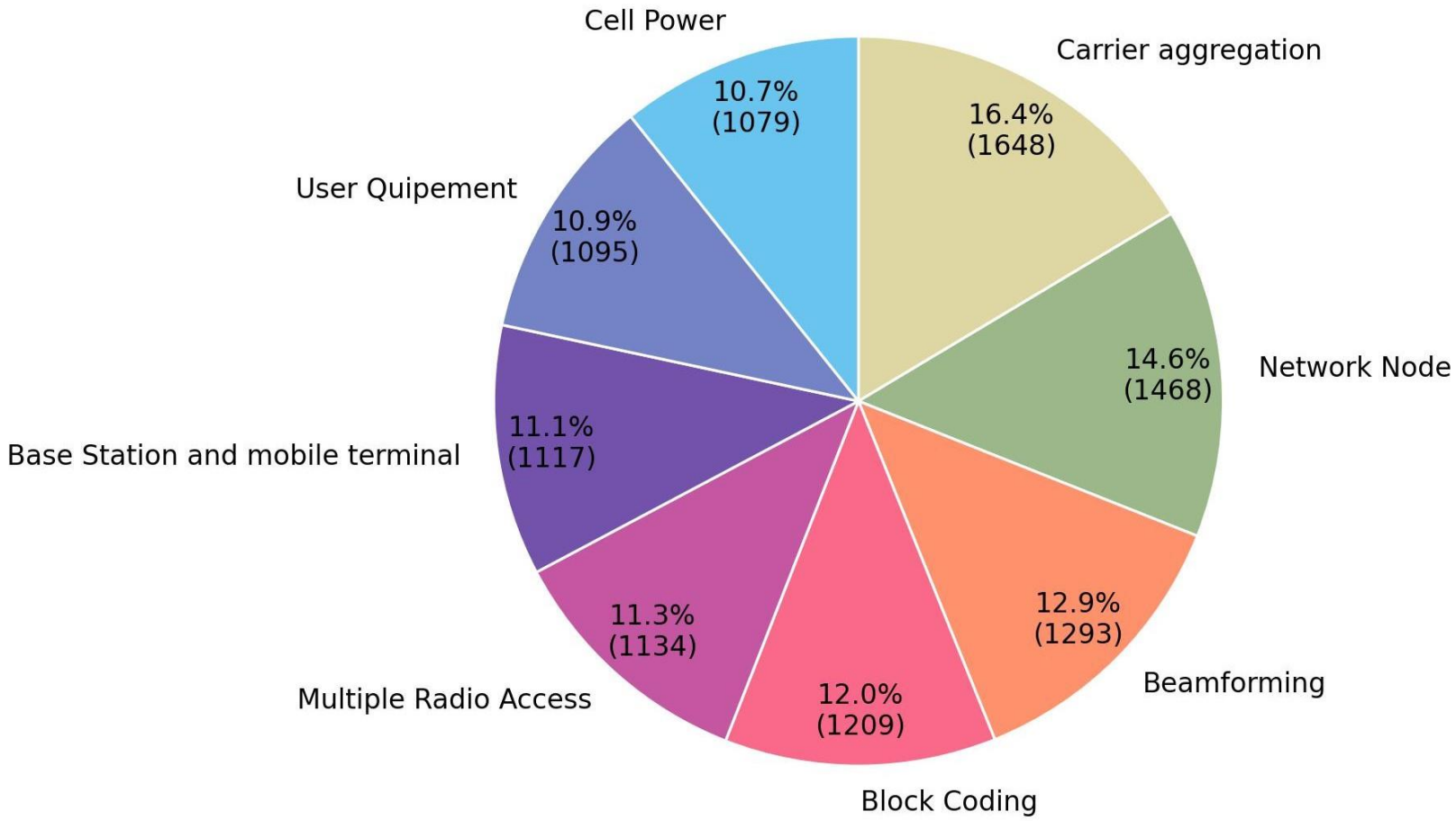
Base Station and Mobile Terminal



Topic Distribution Per Year



Topic Distribution

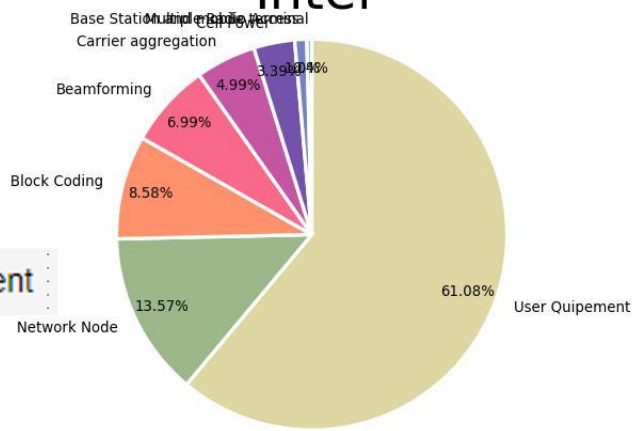


Leading Technology in Each Topic

	Document_No	Assignee	YearPublished	Dominant_Topic	Topic_Labels	Topic_Perc_Contrib
8951	8951	Intel	2017	0	User Quipement	0.5736
1454	1454	LG	2018	1	Multiple Radio Access	0.6040
993	993	LG	2014	2	Carrier aggregation	0.5882
130	130	LG	2009	3	Cell Power	0.5920
329	329	LG	2013	4	Beamforming	0.6101
6698	6698	Huawei	2017	5	Block Coding	0.6706
6931	6931	Huawei	2016	6	Network Node	0.6801
7604	7604	NTT DOCOMO	2013	7	Base Station and mobile terminal	0.5225

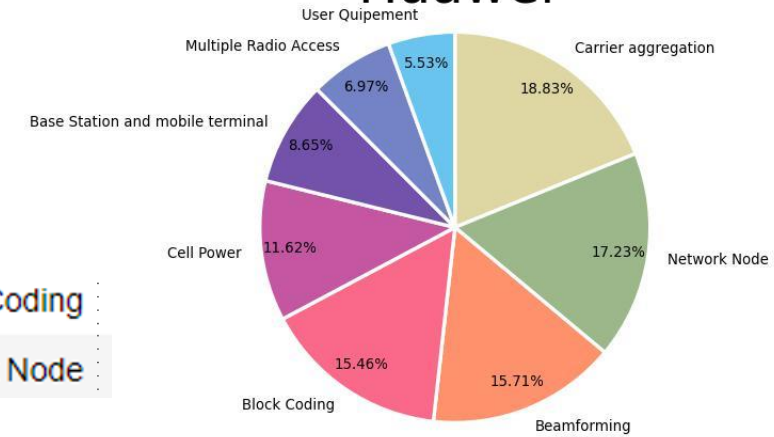
4 Leading Companies

Intel



User Quipement

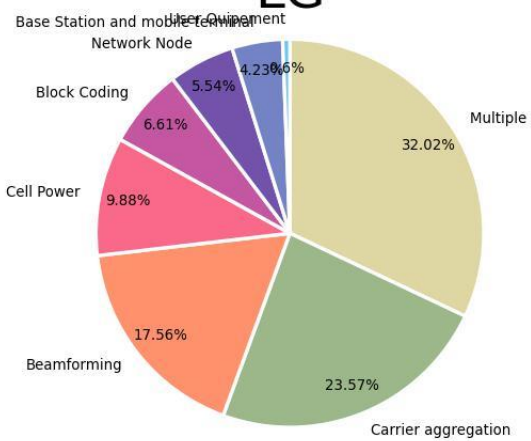
Huawei



Block Coding

Network Node

LG



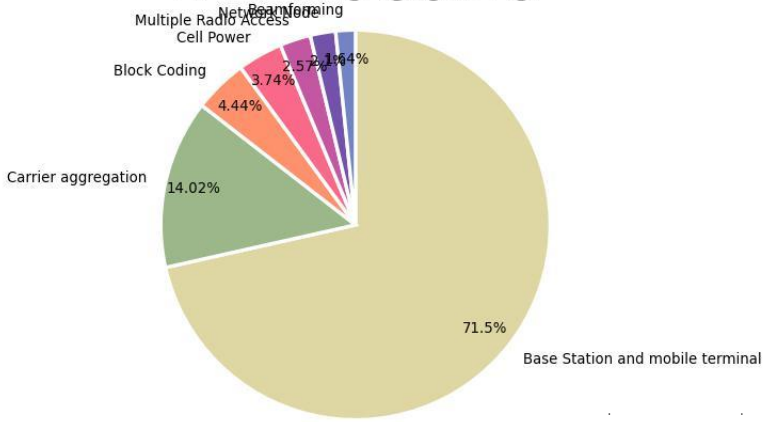
Multiple Radio Access

Carrier aggregation

Cell Power

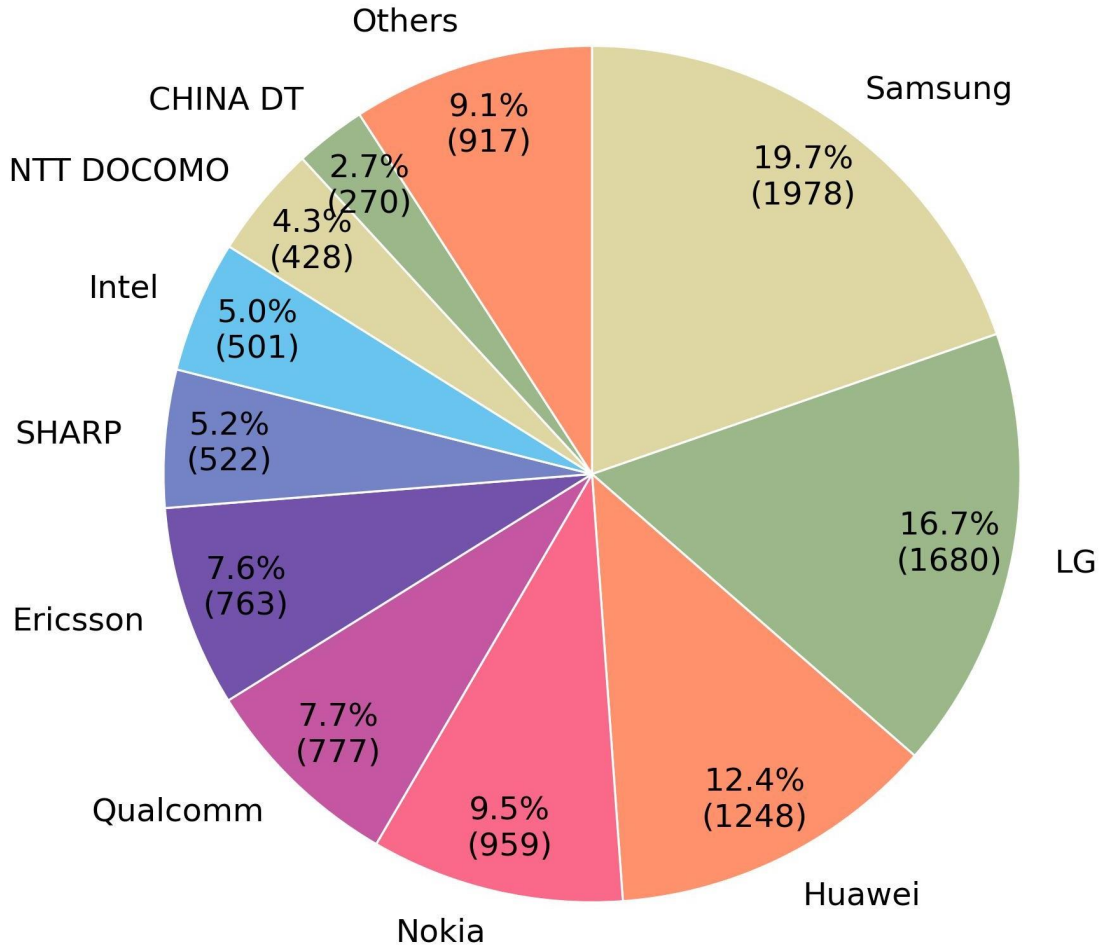
Beamforming

NTT DOCOMO



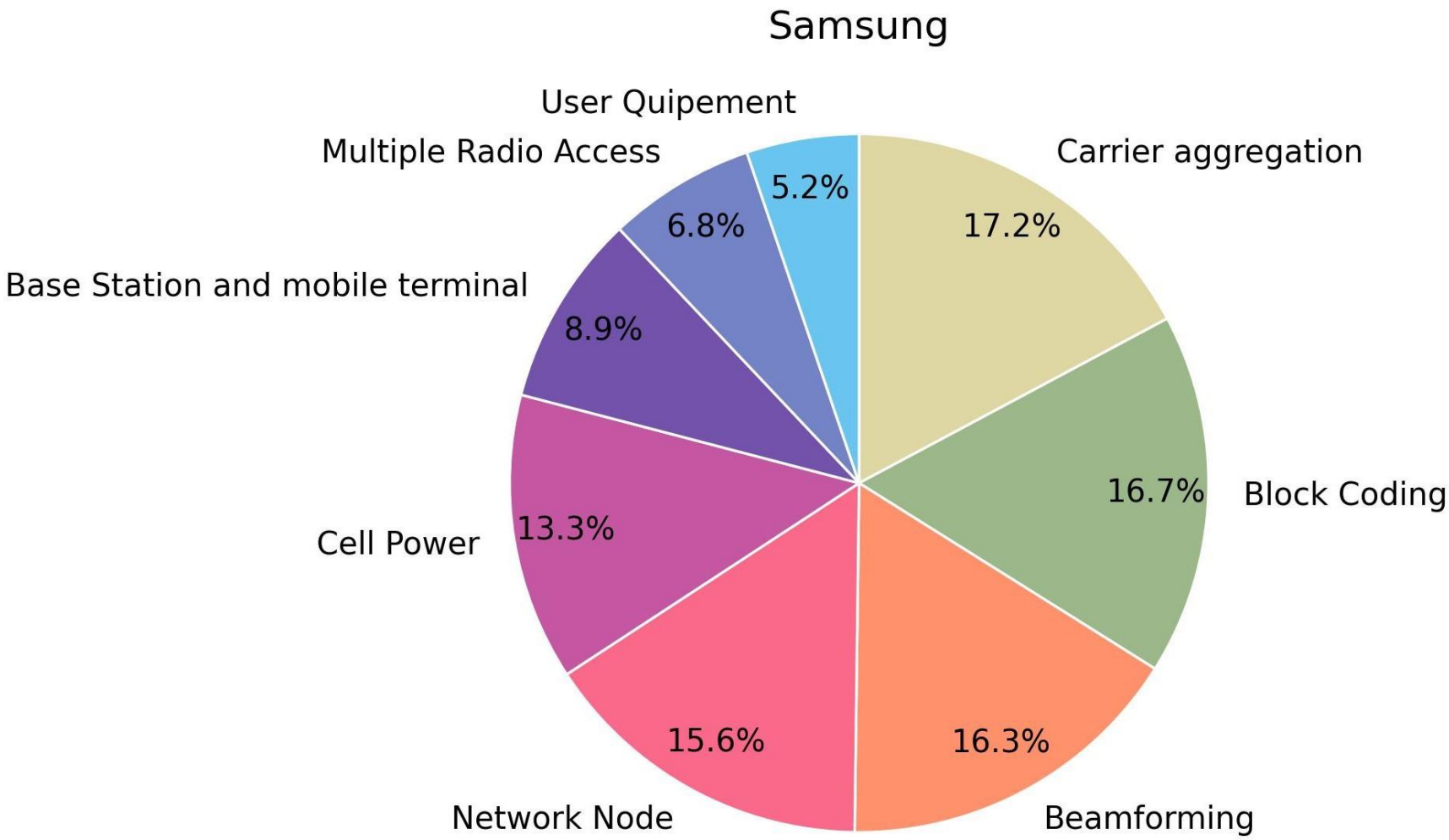
Base Station and mobile terminal

Question: Why does Samsung not have a leading technology?

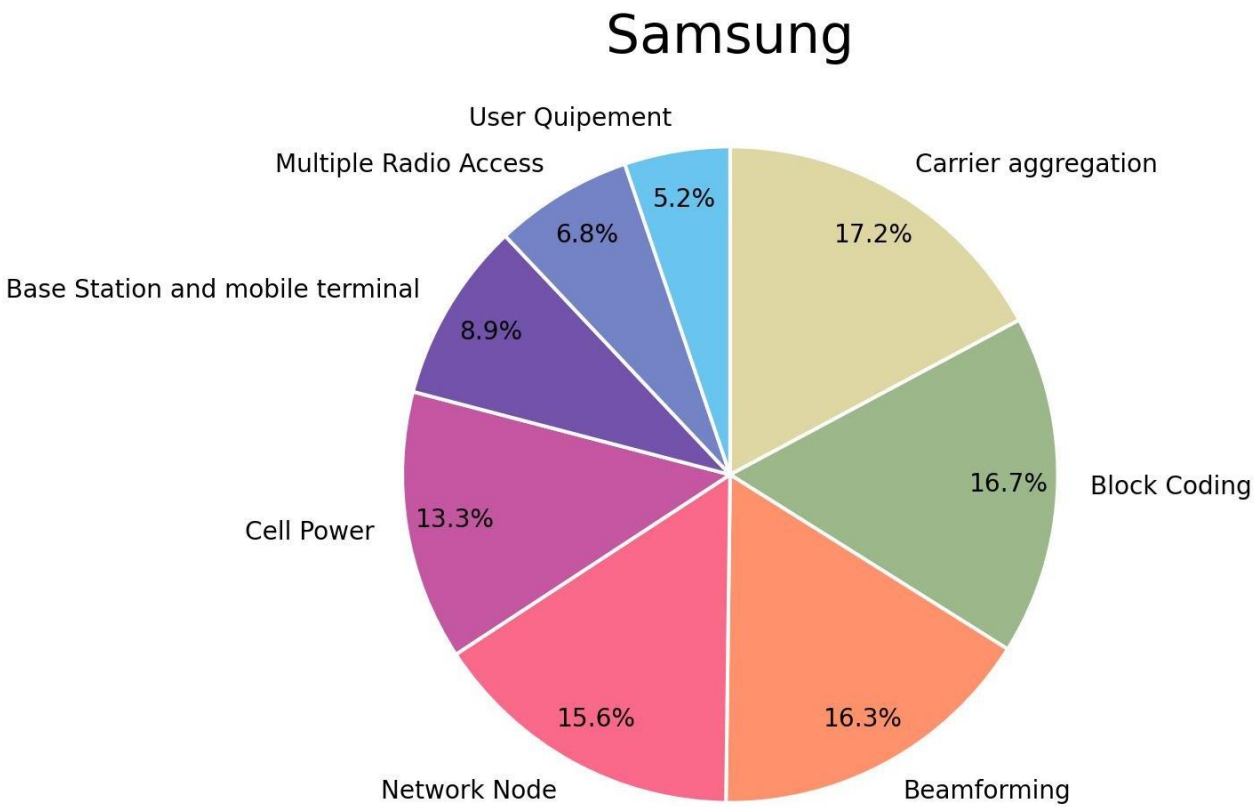


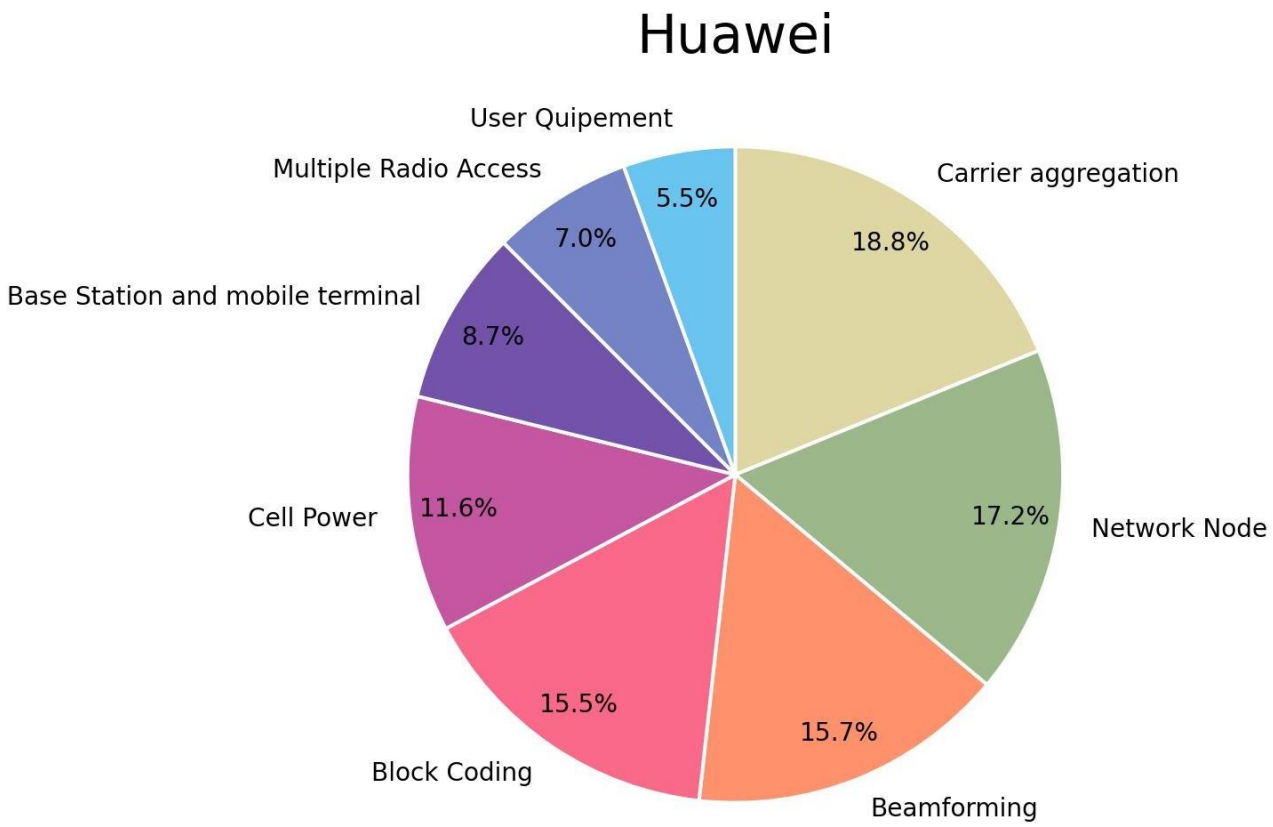
Topic_Labels
User Quipement
Multiple Radio Access
Carrier aggregation
Cell Power
Beamforming
Block Coding
Network Node
Base Station and mobile terminal

Samsung’s Patent Distribution



Patent Distribution Comparison





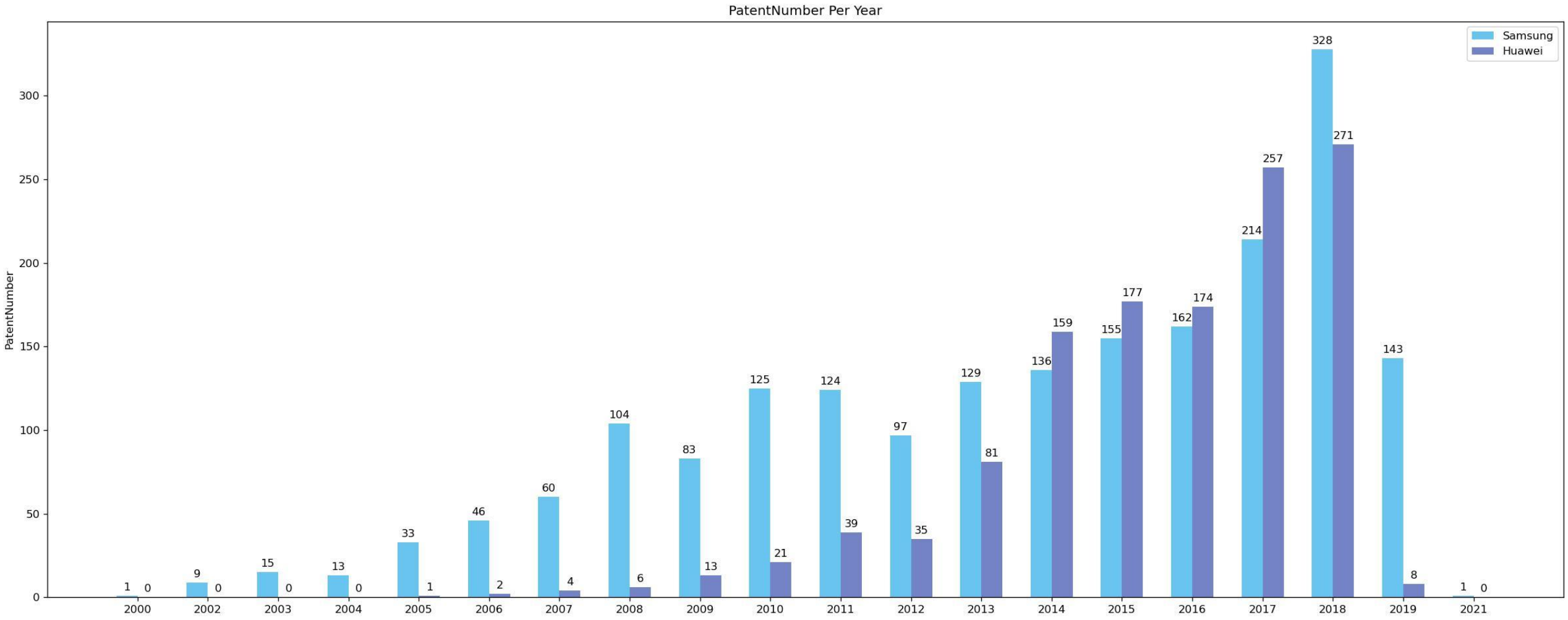
Question Shifted

Question: Why does Samsung not have a leading technology in these topics?

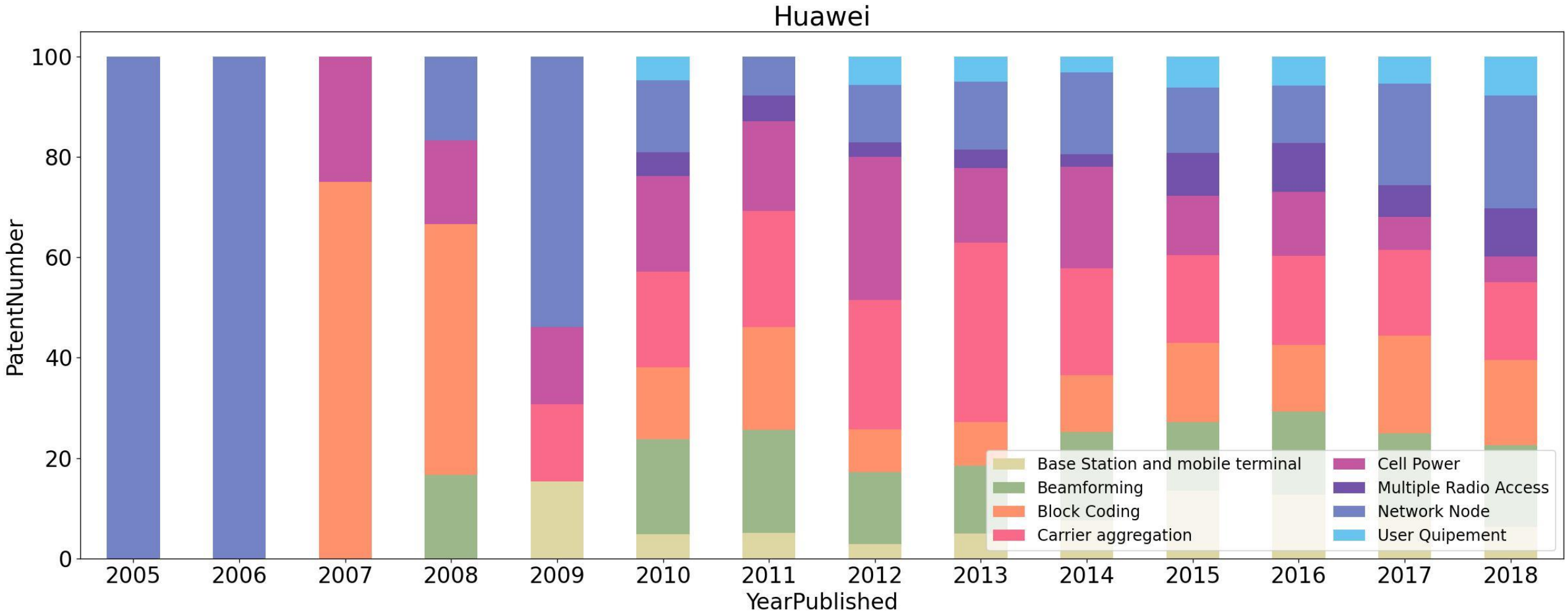
Question: How was Huawei catching up in telecom?

Huawei’s Catch Up 04

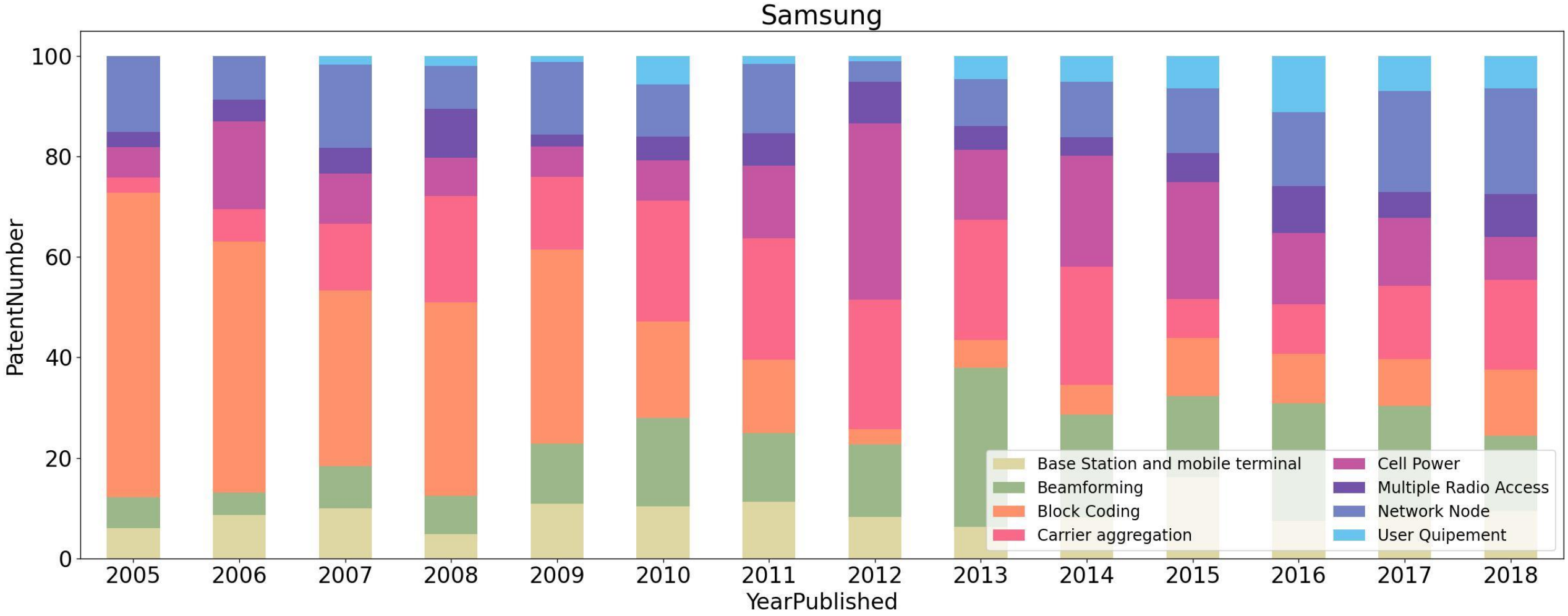
Time Evolution Analysis



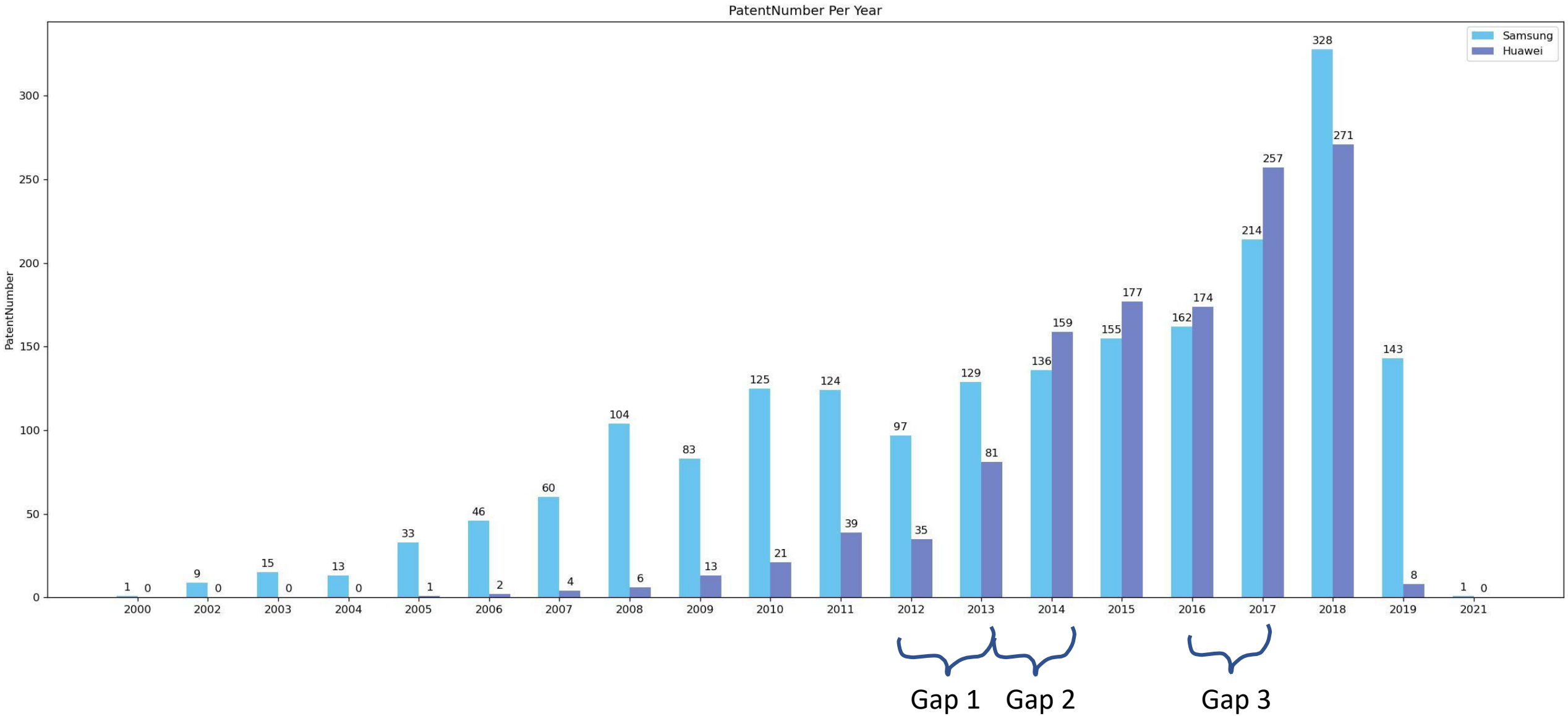
Time Evolution Analysis - Huawei



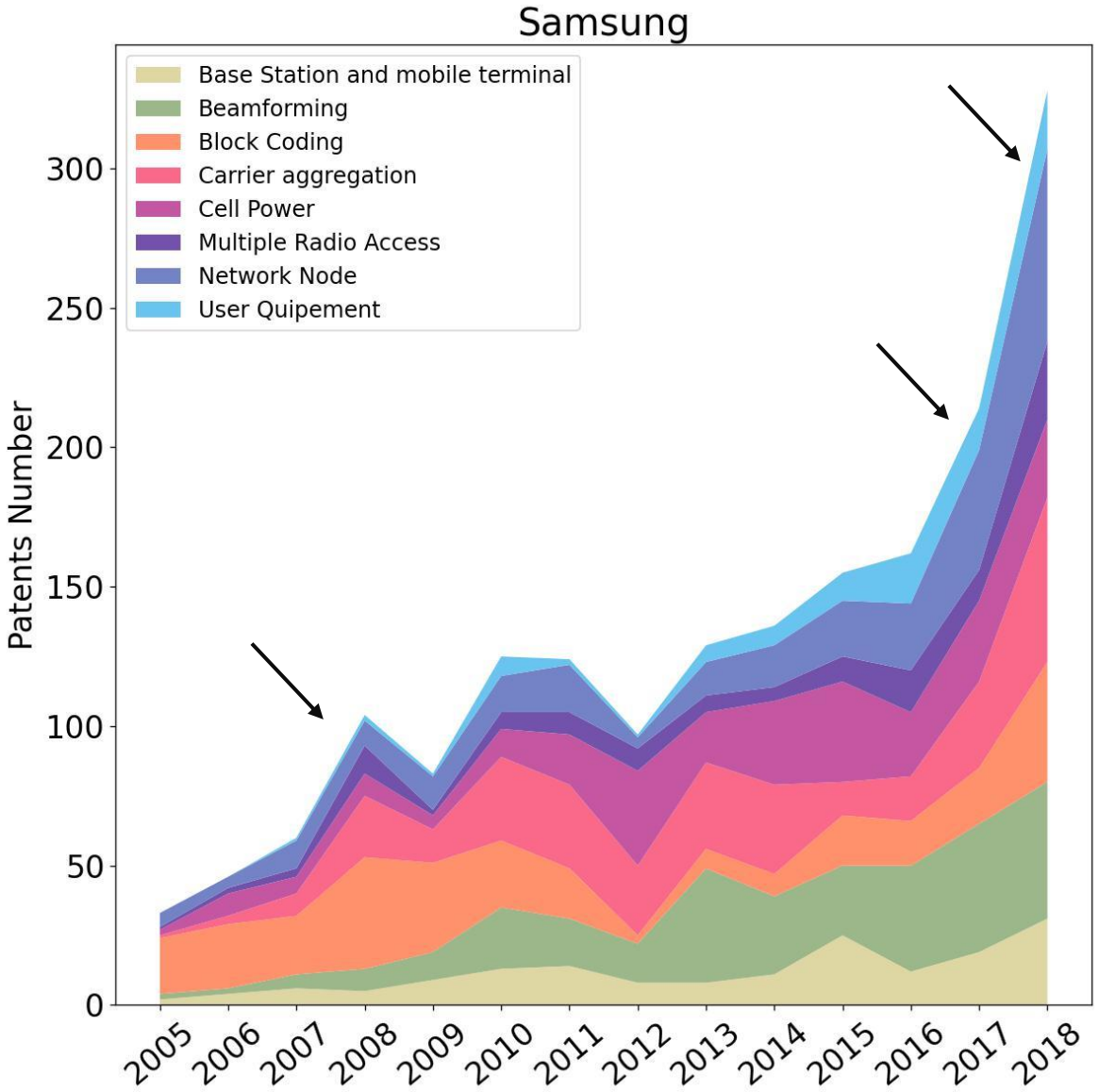
Time Evolution Analysis – Samsung

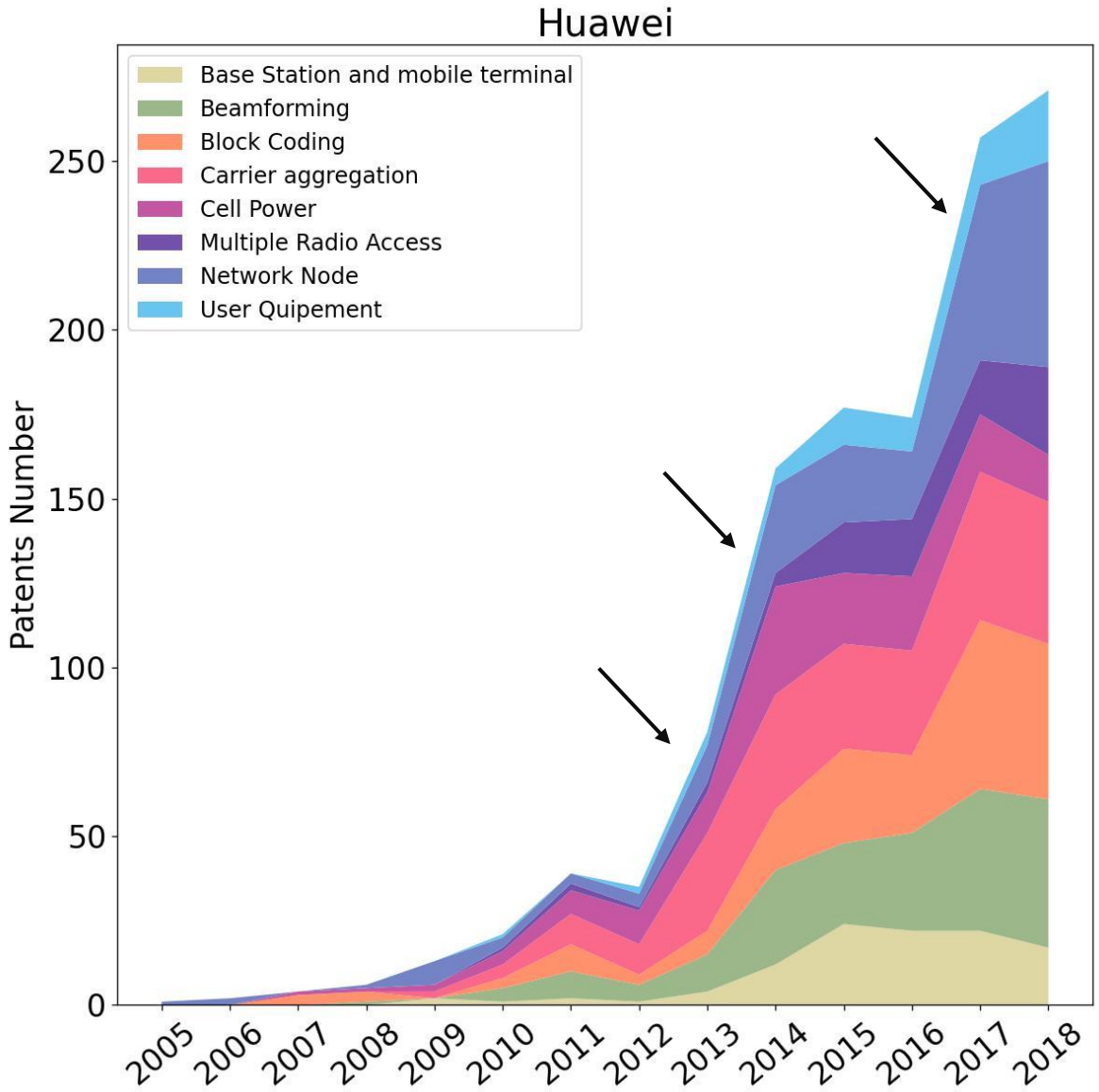


Time Evolution Analysis

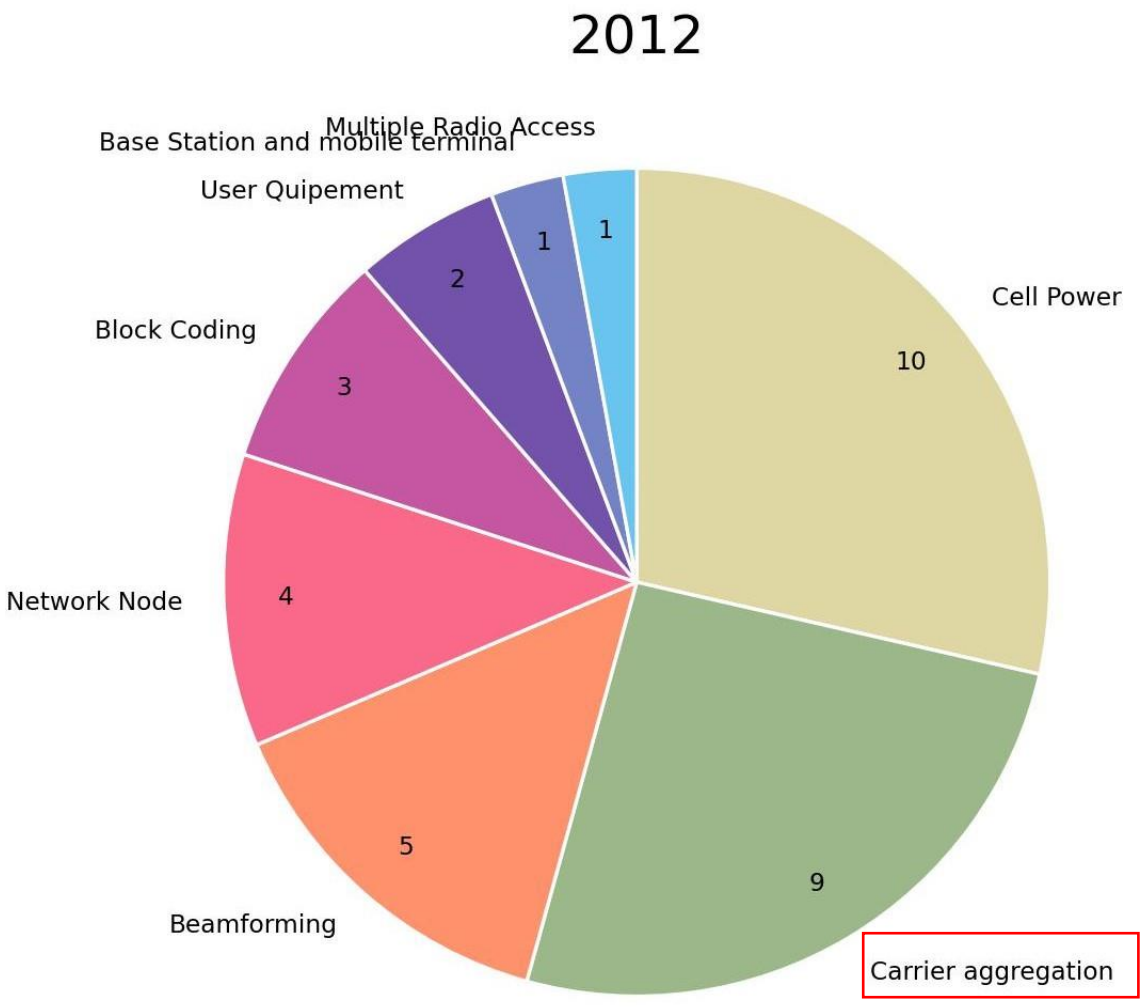


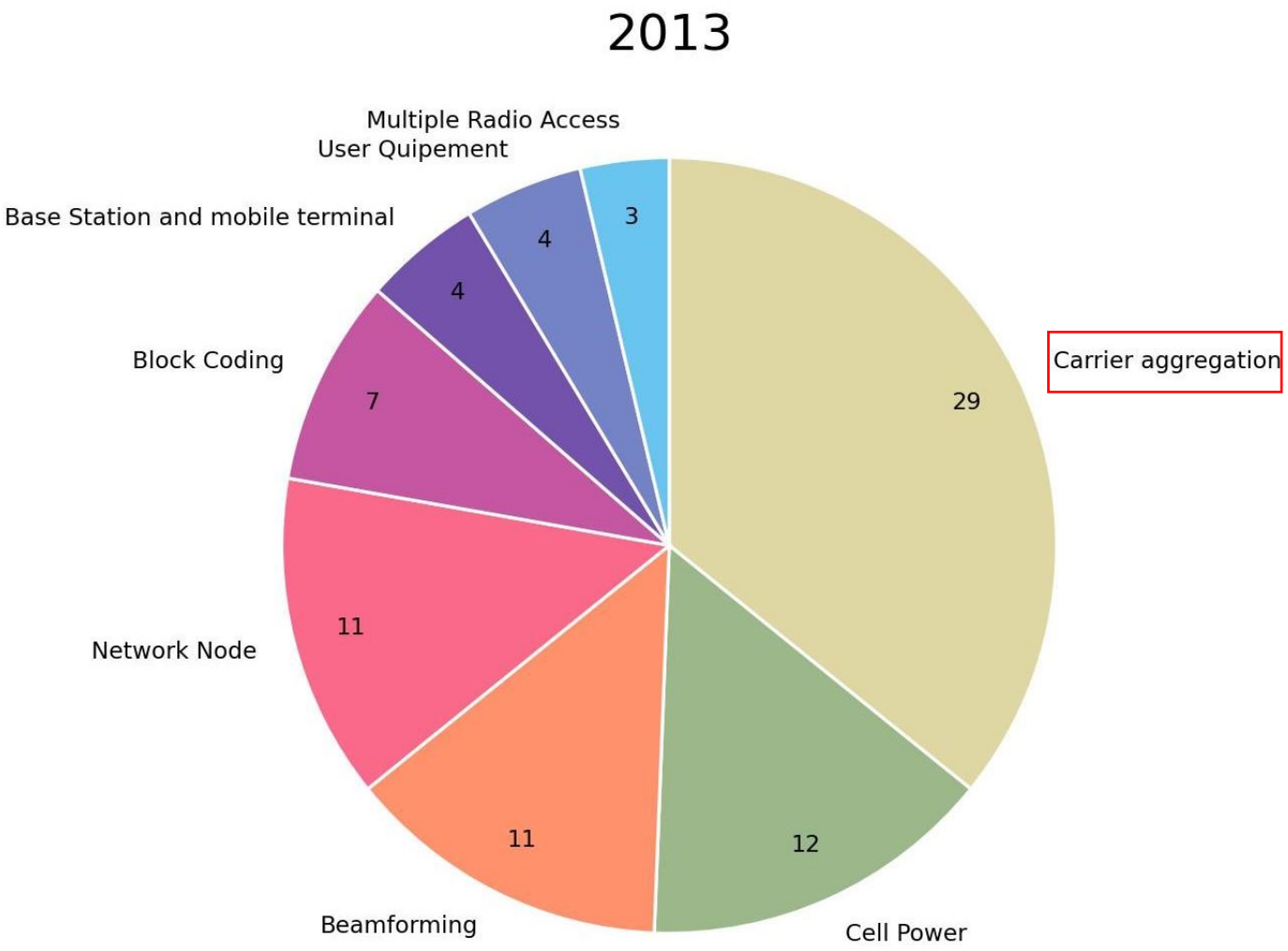
Time Evolution Analysis



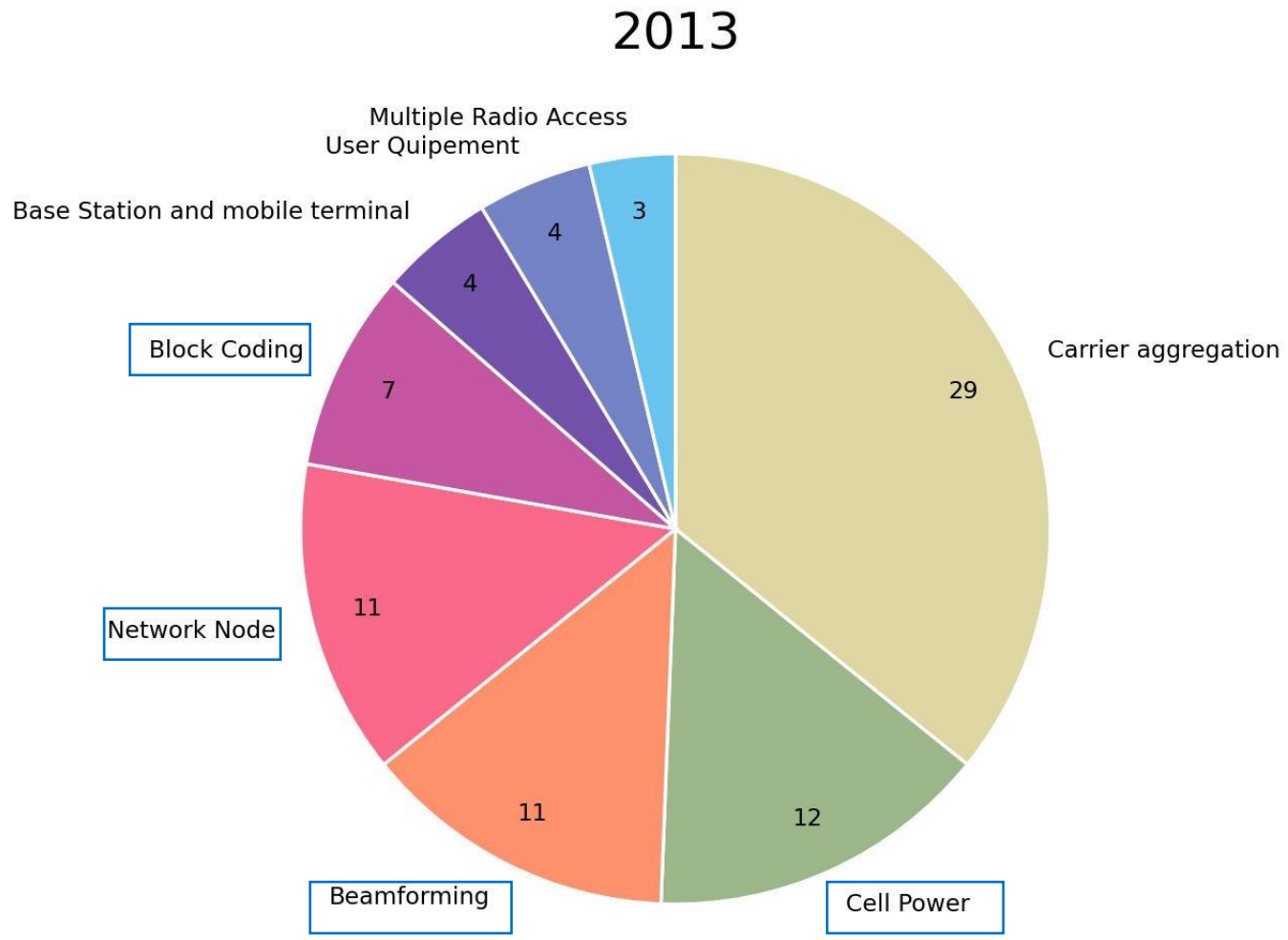


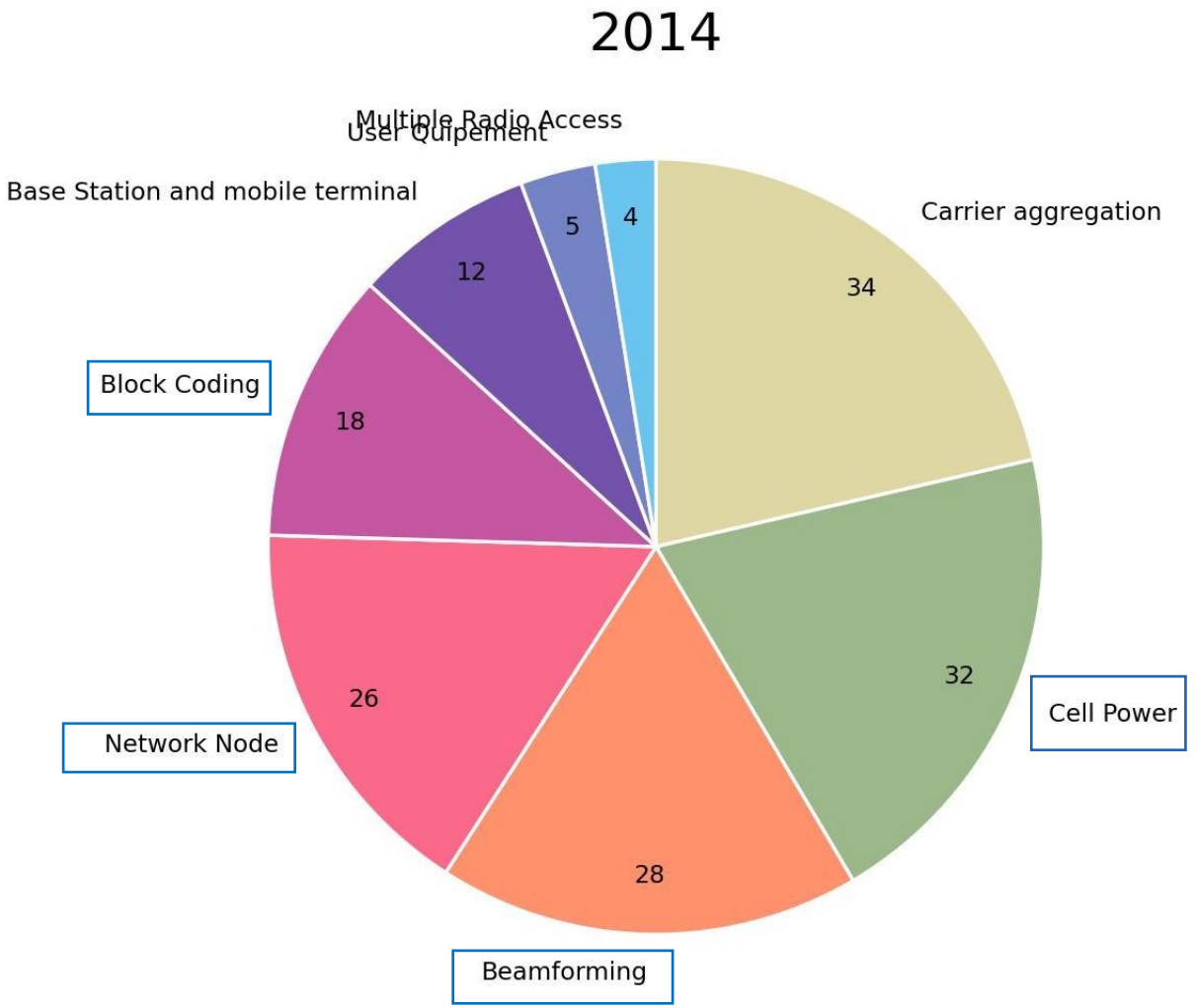
Huawei’s Patent Distribution 2012-2013 (Gap1)



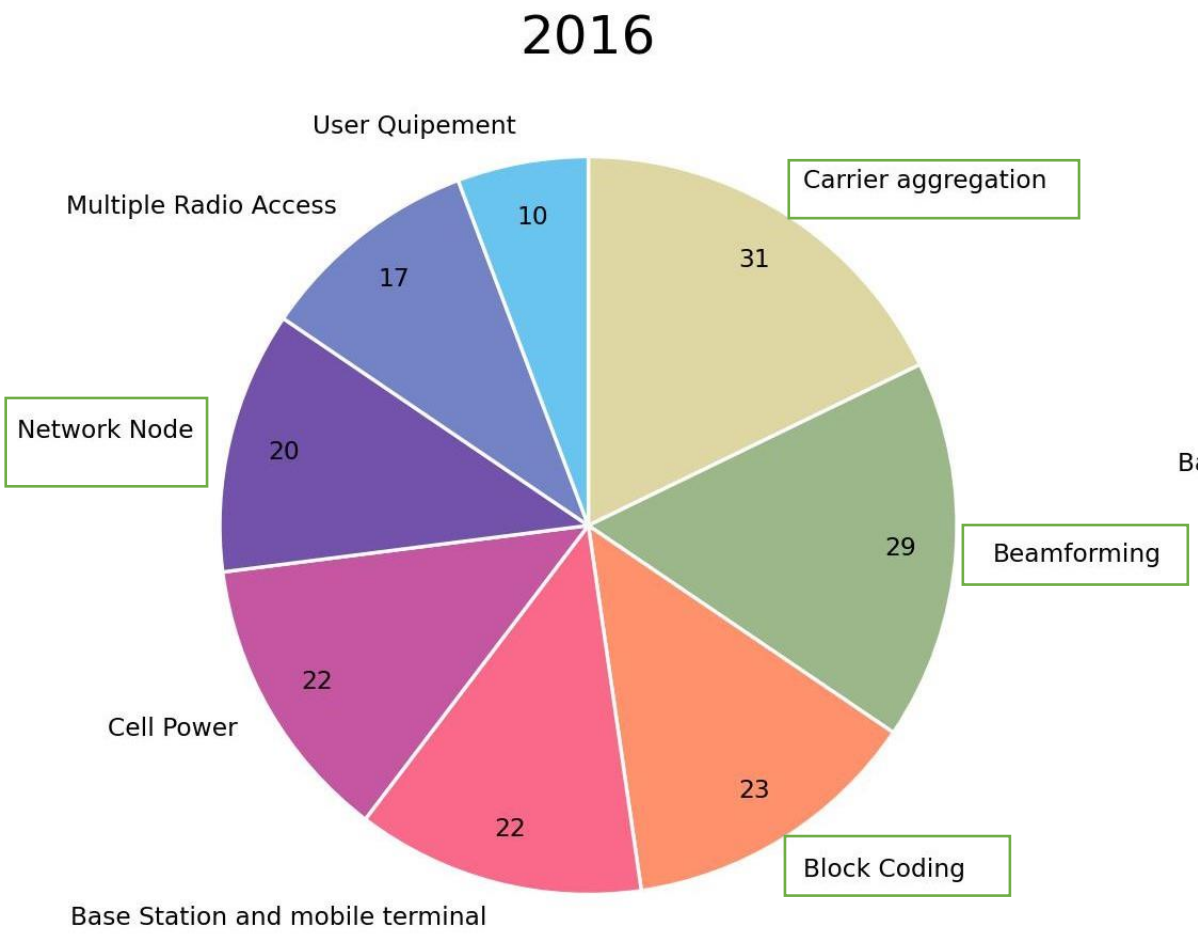


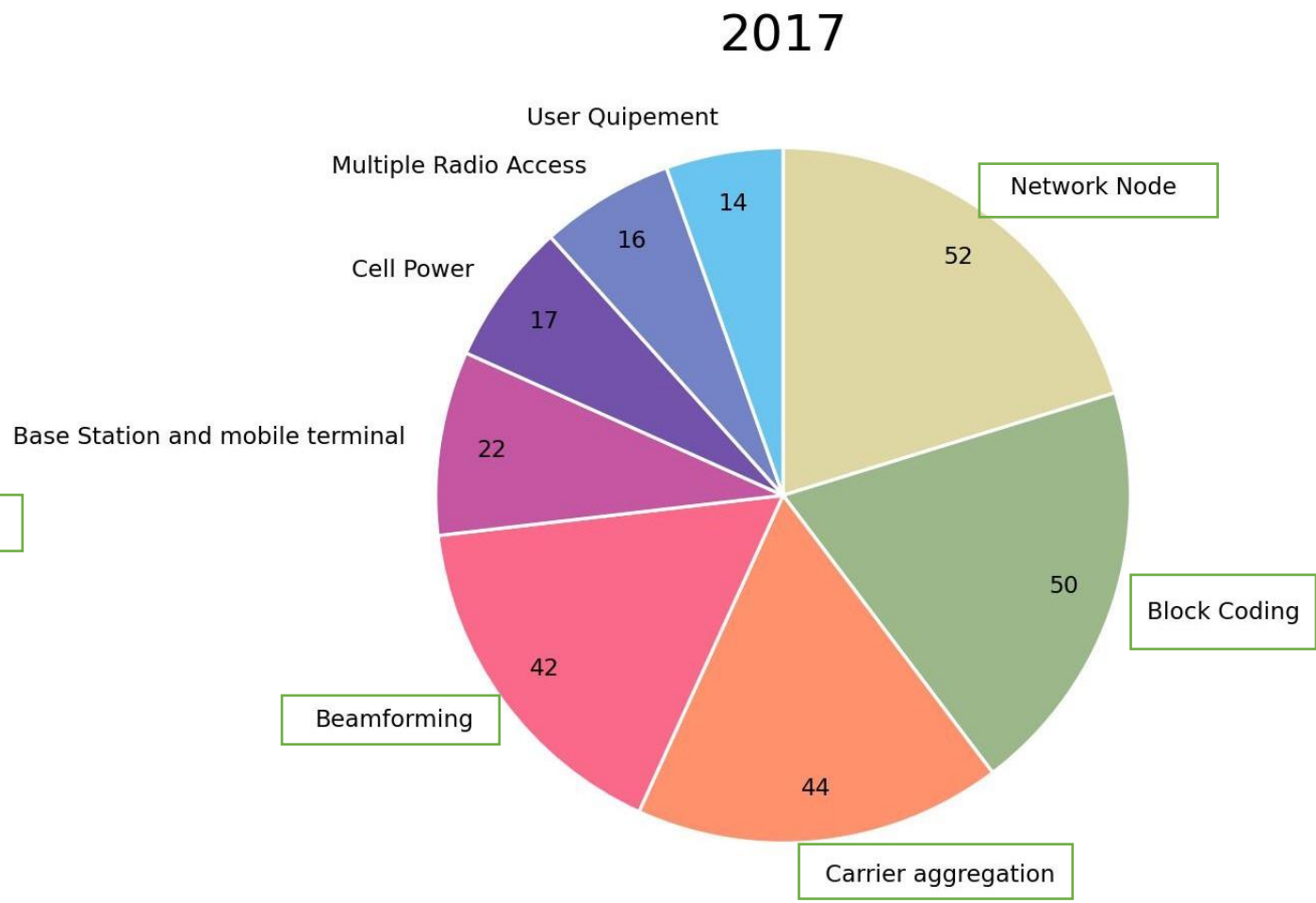
Huawei’s Patent Distribution 2013-2014 (Gap2)





Huawei’s Patent Distribution 2016-2017 (Gap3)





Summary

First Phase: 2012 – 2013 (earlier than 2012)

Mainly Focused on **Carrier Aggregation** while maintaining steady increase in other topics

Second Phase: 2013 – 2014 (earlier than 2013)

Focus shifted to **Cell Power, Beamforming, Network Node, Block Coding** while maintaining steady increase in Carrier Aggregation and other topics

Third Phase: 2016 – 2017 (earlier than 2016)

Focus shifted to **Network Node, Block coding, Carrier Aggregation, Beamforming** while maintaining steady increase in other topics

Appendix 1

2 Companies' Highest Rank of Patent in Each Topic

	Document_No	Assignee	YearPublished	Dominant_Topic	Topic_Labels	Topic_Perc_Contrib	Rank
4514	4514	Samsung	2013	0	User Quipement	0.4455	21
5506	5506	Samsung	2016	1	Multiple Radio Access	0.4433	89
4553	4553	Samsung	2012	2	Carrier aggregation	0.5557	2
4691	4691	Samsung	2011	3	Cell Power	0.5446	6
5562	5562	Samsung	2016	4	Beamforming	0.5550	6
6190	6190	Samsung	2005	5	Block Coding	0.6145	8
4974	4974	Samsung	2018	6	Network Node	0.6640	2
5839	5839	Samsung	2010	7	Base Station and mobile terminal	0.3843	78

	Document_No	Assignee	YearPublished	Dominant_Topic	Topic_Labels	Topic_Perc_Contrib	Rank
6509	6509	Huawei	2018	0	User Quipement	0.4917	7
6317	6317	Huawei	2018	1	Multiple Radio Access	0.4207	147
7209	7209	Huawei	2014	2	Carrier aggregation	0.5318	4
7344	7344	Huawei	2013	3	Cell Power	0.5557	4
6778	6778	Huawei	2017	4	Beamforming	0.6000	3
6698	6698	Huawei	2017	5	Block Coding	0.6706	1
6931	6931	Huawei	2016	6	Network Node	0.6801	1
7287	7287	Huawei	2014	7	Base Station and mobile terminal	0.4248	23

Appendix 2

2 Companies' Top 3 Increasing Patent Topics

	Year	S_1st	S_2nd	S_3rd	H_1st	H_2nd	H_3rd
1	2006	Cell Power	Carrier aggregation	Base Station and mobile terminal	Network Node	Base Station and mobile terminal	Beamforming
2	2007	Carrier aggregation	Beamforming	Network Node	Base Station and mobile terminal	Beamforming	Block Coding
3	2008	Multiple Radio Access	Carrier aggregation	User Quipement	Base Station and mobile terminal	Beamforming	Block Coding
4	2009	Base Station and mobile terminal	Network Node	Beamforming	Network Node	Cell Power	Base Station and mobile terminal
5	2010	User Quipement	Multiple Radio Access	Carrier aggregation	Carrier aggregation	Cell Power	Beamforming
6	2011	Cell Power	Multiple Radio Access	Network Node	Block Coding	Carrier aggregation	Base Station and mobile terminal
7	2012	Cell Power	Multiple Radio Access	Carrier aggregation	Cell Power	Network Node	Carrier aggregation
8	2013	User Quipement	Network Node	Beamforming	Base Station and mobile terminal	Carrier aggregation	Multiple Radio Access
9	2014	Cell Power	Base Station and mobile terminal	Network Node	Base Station and mobile terminal	Cell Power	Block Coding
10	2015	Base Station and mobile terminal	Block Coding	Multiple Radio Access	Multiple Radio Access	User Quipement	Base Station and mobile terminal
11	2016	User Quipement	Multiple Radio Access	Beamforming	Beamforming	Multiple Radio Access	Cell Power
12	2017	Carrier aggregation	Network Node	Base Station and mobile terminal	Network Node	Block Coding	Beamforming
13	2018	Multiple Radio Access	Block Coding	Carrier aggregation	Multiple Radio Access	User Quipement	Network Node

Multiple Radio Access: A mobile device that can connect to more than one type of cellular network.
5G is about connecting things everywhere while enabling new use cases.

THANKS

Thank You For Listening

2022.7.4