International Journal of Scientific Research in Computer Science, Engineering and Information Technology

ISSN : 2456-3307 OPEN ACCESS

Available Online at : www.ijsrcseit.com

doi : https://doi.org/10.32628/CSEIT2390637

SoftCell: Scalable and Flexible Cellular Core Network Architecture

Sathvik Reddy Thogaru, Harshitha Parupalli, Avanthika Makkena

Department of Computer Science University, New jersey institute of technology, Harrison, New Jersey, USA

ARTICLEINFO

Article History:

Accepted: 02 Dec 2023

Published: 19 Dec 2023

Publication Issue

Volume 9, Issue 6

November-December-2023

Page Number

255-260

ABSTRACT

SoftCell is introduced as a scalable architecture for addressing challenges in cell core networks, characterised by means of inflexible and highly-priced gadget, at the side of complex control-plane protocols. This answer leverages commodity switches and servers to permit high-quality-grained policies for cellular gadgets. SoftCell allows the implementation of high-stage carrier regulations, directing site visitors through sequences of middleboxes based totally on subscriber attributes and packages. To optimize forwarding tables, the architecture aggregates traffic across numerous dimensions, along with carrier coverage, base station, and cell tool. Fine-grained packet classification is carried out at get admission to switches to deal with state and bandwidth necessities effectively. SoftCell guarantees that packets from the identical connection traverse the equal middlebox collection in each guideline, regardless of mobility. The effectiveness of SoftCell is established via evaluation of real LTE workloads, micro-benchmarks on the prototype controller, and massive-scale simulations, showcasing progressed scalability and versatility in cellular middle networks.

Keywords: Softcell, LTE workloads, micro-benchmarks

I. INTRODUCTION

The project introduces a solution, SoftCell, to address the challenges posed by the explosive growth of cellular data traffic. The surge in usage, driven by the proliferation of devices like smartphones, tablets, and Machine-to-Machine (M2M) devices, has strained cellular core networks. Although advancements like Long Term Evolution (LTE) have expanded radio access capacity, the core networks now grapple with accommodating the escalating demand.

The project introduces a solution, SoftCell, to address the challenges posed by the explosive growth of cellular data traffic. The surge in usage, driven by the proliferation of devices like smartphones, tablets, and Machine-to-Machine (M2M) devices, has strained cellular core networks. Although advancements like Long Term Evolution (LTE) have expanded radio access capacity, the core networks now grapple ith accommodating the escalating demand.

Unlike traditional IP networks, cellular providers heavily rely on customized policies based on diverse

subscriber attributes and application types. These attributes include device type, operating system version, billing plan, parental controls, and roaming status, while application types range from video transcoding to web caching. Specialized devices like Serving Gateways (S-GWs) and Packet data network Gateways (P-GWs) currently handle data-plane functionalities in a centralized manner.

However, this approach leads to inefficiencies, complexity, and inflexibility.

II. KEY SIMILARITIES

1. Traffic Growth Concerns:
Both projects acknowledge the exponential growth in cellular data traffic and the need for scalable solutions to handle this increase.

2. Technology Trends:
Both projects recognize the importance of new cellular technologies, such as Long-Term Evolution (LTE), in managing and accommodating the growth in data traffic.

3. Customized Policies:
Both projects highlight the reliance of cellular providers on customized policies based on subscriber attributes and application types, indicating the need for flexible and adaptive solutions.

4. Role of Middleboxes:
Both projects propose the use of middleboxes to handle specific functionalities, such as traffic optimization, firewalls, and lawful intercept, in the cellular core network.

5. Inefficiencies in Current Design:
Both projects identify inefficiencies in the current design of cellular core networks, particularly in the centralized nature of Packet data network Gateways (P-GWs) and the associated drawbacks.

6. Need for Scalability:
Both projects emphasize the importance of scalability, recognizing that the current design may not scale effectively with the increasing demands on cellular networks.

7. Aggregation Techniques:
Both projects leverage aggregation techniques to minimize the size of forwarding tables, acknowledging the limitations of commodity switches in handling a large number of packet classifiers.

8. Centralized Controller:
Both projects propose a logically centralized controller to manage and route traffic through the network, providing a high-level service policy.

9. Packet Classification at Access Edge:
Both projects advocate for performing fine-grained packet classification at the access edge, using software switches and local controllers to improve efficiency and flexibility.

10. Consideration for Mobility:
Both projects recognize the challenge of device mobility in cellular networks and address the need for additional state to ensure seamless connectivity.

11. Utilization of Modern Switch Capabilities:
Both projects take advantage of modern switch capabilities, such as TCAMs with wildcard matching, to optimize the handling of forwarding entries and reduce the need for extensive rule storage.

Paper Organization:

- Describes the SoftCell architecture, technical challenges, and solutions.
- Explores multi-dimensional aggregation and asymmetric edge design.
- Discusses how SoftCell handles various network dynamics.
- Provide a performance evaluation.

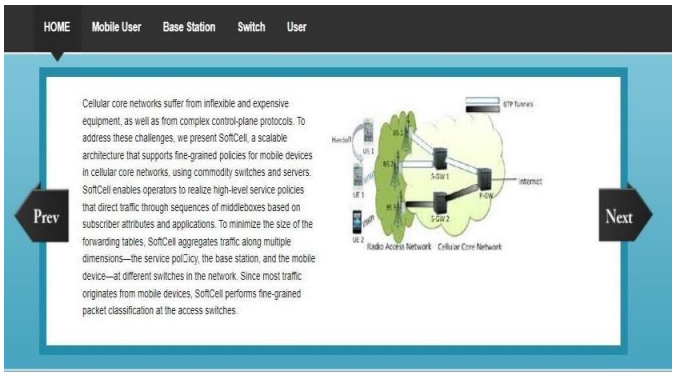
Implementation and Evaluation:

SoftCell controller built on Floodlight.
Evaluation using real LTE traces, micro-benchmarks, and large-scale simulation experiments.
SoftCell demonstrated the ability to handle a large LTE network workload efficiently.

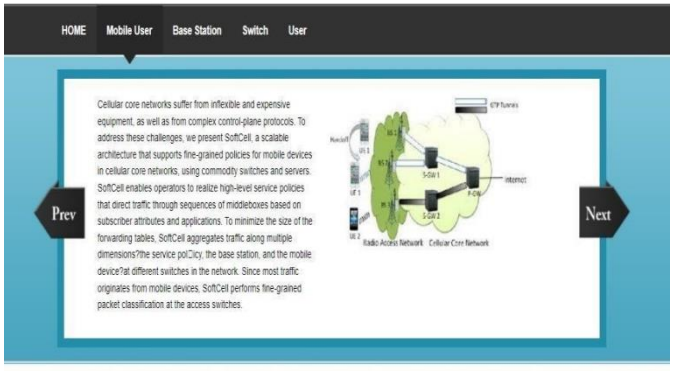
Soft Cell Techniques :
1. Multi-dimensional Aggregation
2. Smart Access Edge, Dumb Gateway Edge

Future Discussions :
Further discussions on SoftCell and related work.
A conclusion summarizing key findings.

III. RESULTS AND DISCUSSION



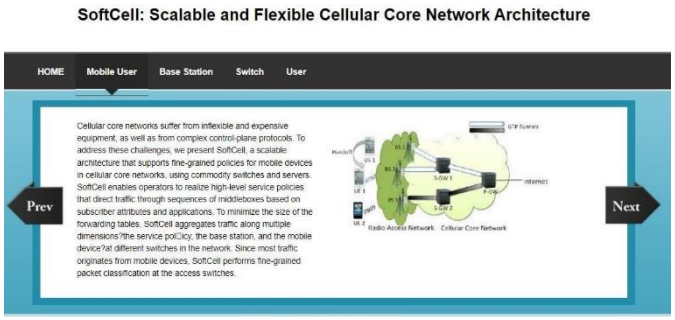
Welcome to SoftCell: Scalable and Flexible Cellular Core Network Architecture



Mobile User Login

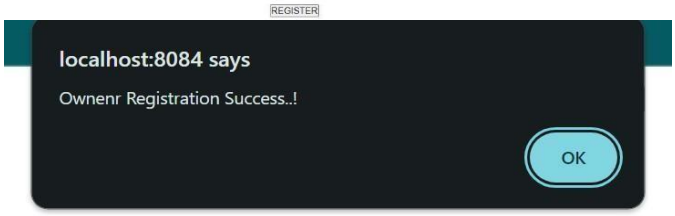
Email :
Password :
Login

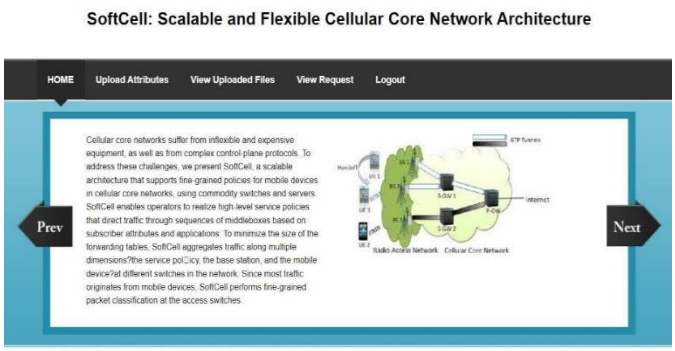
Click Here for Registration



Mobile User Registration

User Name dhristi
Password ••••
Email ID dhristi23@gmail.com
Select Gender FEMALE
Address Kolkata
Mobile Number 9675870982
Face Image Choose File in.txt
REGISTER

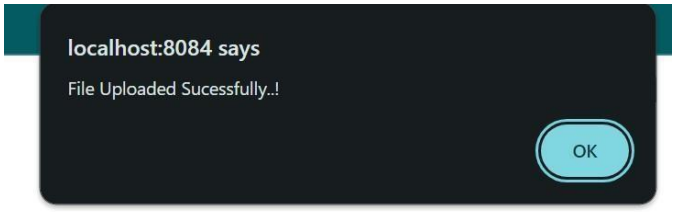




Welcome dhristi

Upload Data

Video Yes
Voice Yes
VOIP Bill Paid
Phone Modal iphone
Select File Choose File in.txt
Upload

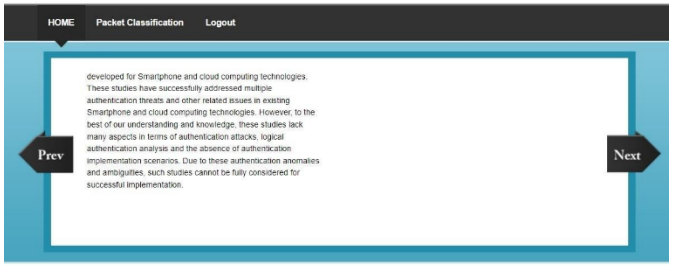


SoftCell: Scalable and Flexible Cellular Core Network Architecture

Base Station Login

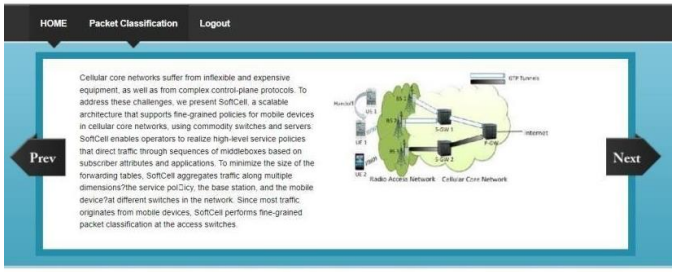
User Name : base
Password : ••••
Login

SoftCell: Scalable and Flexible Cellular Core Network Architecture



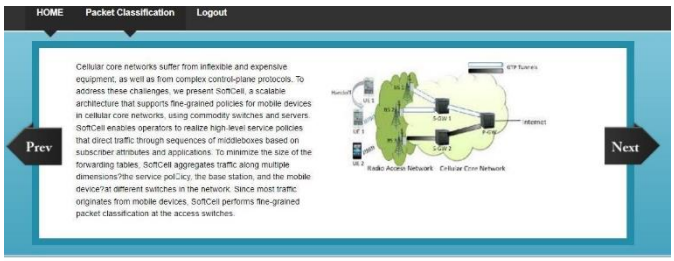
Welcome Base Station

SoftCell: Scalable and Flexible Cellular Core Network Architecture



Packet Classification Based on Attribute

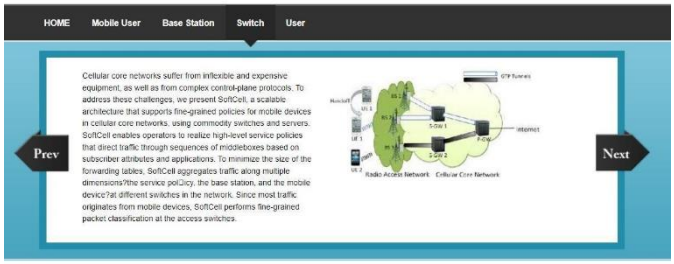
Attribute Video
View



View

File Name	Uploaded Date	Uploaded By	Mobile	Video	DATA	Send
ne.txt	2023-12-13 00:00:00.0	shiva@gmail.com	I Phone	yes	Building formulas Cell formatting	Click
in.txt	2023-12-13 00:00:00.0	priya@gmail.com	iphone	yes	mobile data	Click
in.txt	2023-12-15 00:00:00.0	dhrist23@gmail.com	iphone	yes	mobile data	Click

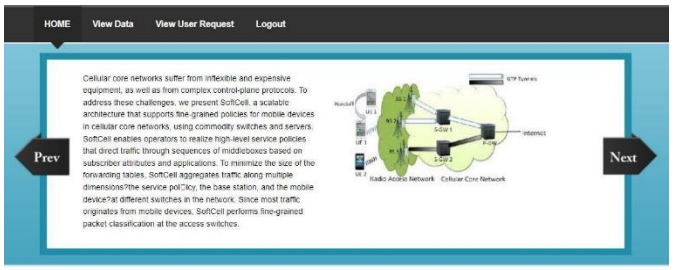
SoftCell: Scalable and Flexible Cellular Core Network Architecture



Switch User Login

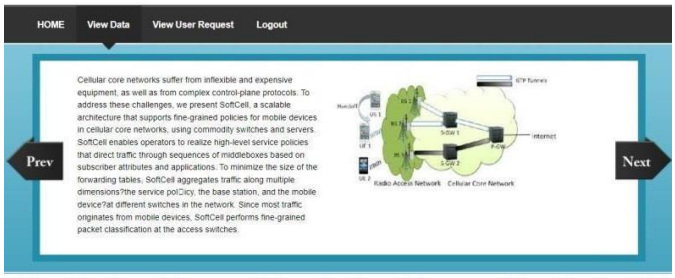
User Name : switch
Password : ••••••
Switch Type Video
Login

SoftCell: Scalable and Flexible Cellular Core Network Architecture



Welcome Switch

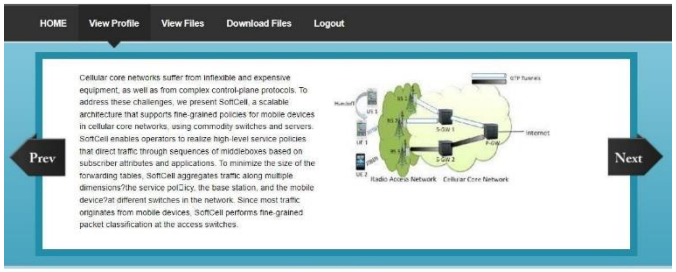
SoftCell: Scalable and Flexible Cellular Core Network Architecture



View Data

File Name	Mobile User	Mobile Type	Switch Type	Data
ne.txt	shiva@gmail.com	I Phone	video	Building formulasCell
in.txt	priya@gmail.com	iphone	video	mobile data

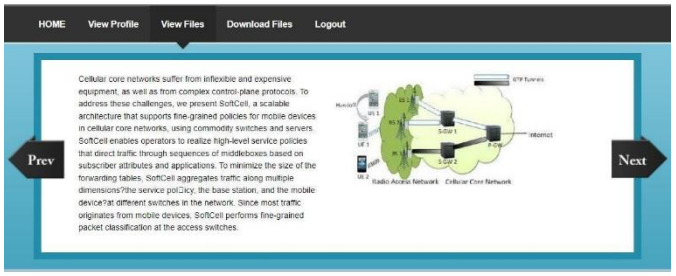
SoftCell: Scalable and Flexible Cellular Core Network Architecture



View Profile

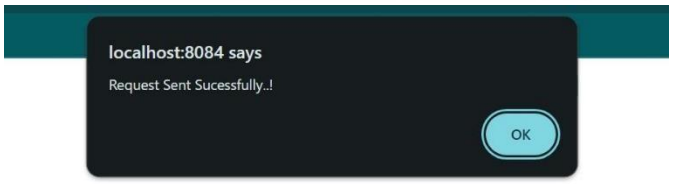
User Name	Email	Gender	Address
dhristi	dhristi23@gmail.com	FEMALE	Kolkata

SoftCell: Scalable and Flexible Cellular Core Network Architecture

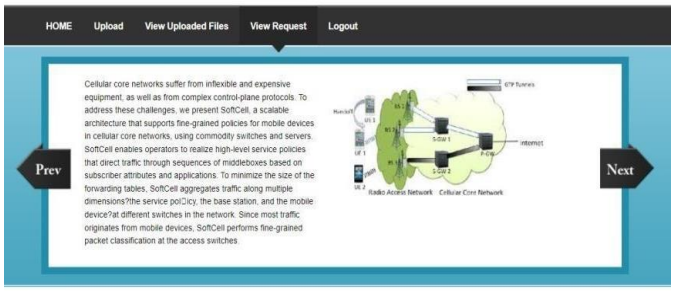


View Data

File Name	Uploaded Date	Owner	Request
ne.txt	2023-12-13 00:00:00.0	shiva@gmail.com	click
in.txt	2023-12-13 00:00:00.0	priya@gmail.com	click
in.txt	2023-12-15 00:00:00.0	dhristi23@gmail.com	click



SoftCell: Scalable and Flexible Cellular Core Network Architecture



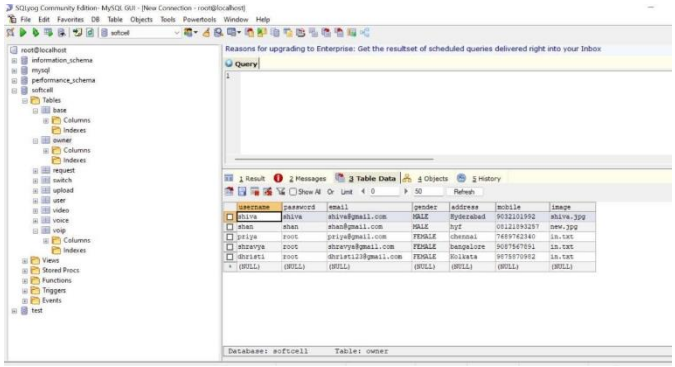
View Download Request

File Name	Mobile	user
in.txt	iphone	dhristi23@gmail.com

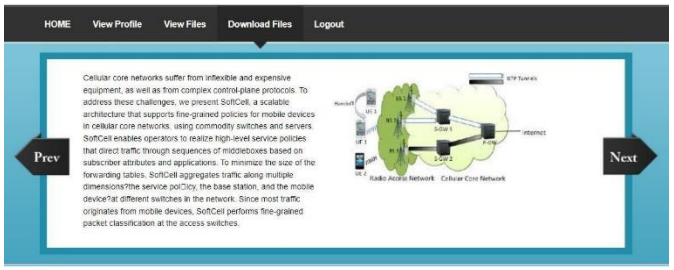
SoftCell: Scalable and Flexible Cellular Core Network Architecture

View Data & Download

File Name	Mobile User	Data	Mobile	Video	Voice	Bill	Download
in.txt	dhristi23@gmail.com	mobile data	iphone	yes	yes	paid	click

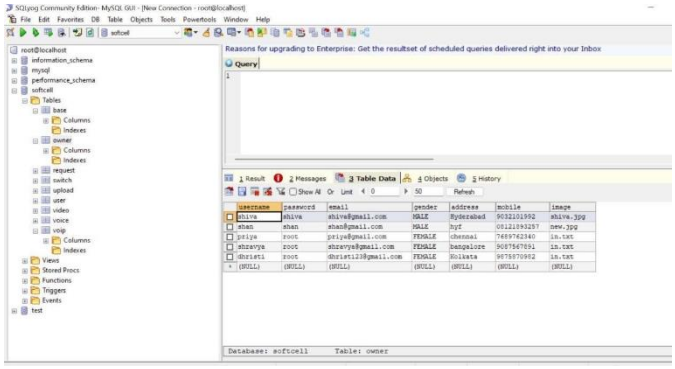


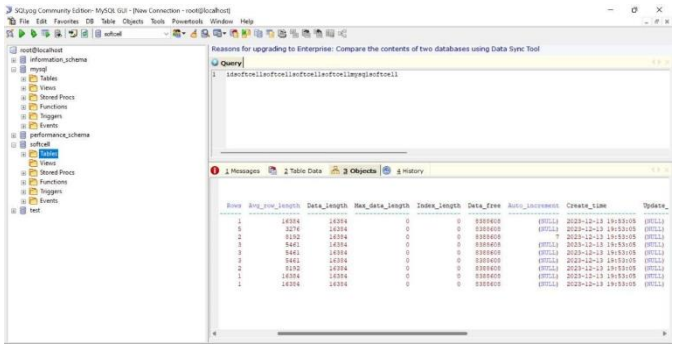
SoftCell: Scalable and Flexible Cellular Core Network Architecture

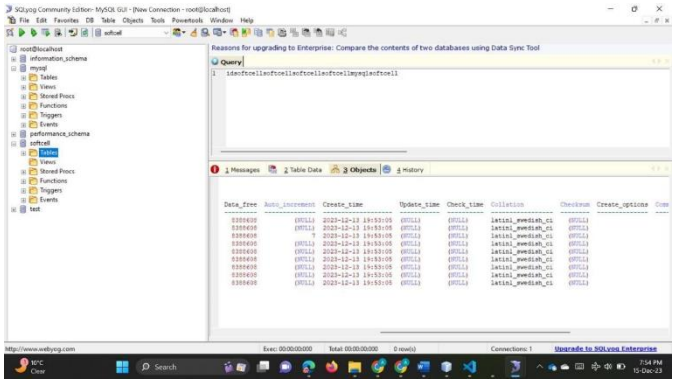


View Data & Download

File Name	Mobile User	Data	Mobile	Video	Voice	Bill	Download
in.txt	dhristi23@gmail.com	mobile data	iphone	yes	yes	paid	click







IV.CONCLUSION

In this research paper we present SoftCell, an architecture we've developed to tackle the issues of costs and limited flexibility, in cellular core networks today. SoftCell aims to improve scalability in the data plane by using two strategies; (i) shifting classification to low bandwidth access switches and (ii) reducing the core networks load by efficiently aggregating forwarding rules in multiple dimensions. To achieve scalability in the control plane SoftCell utilizes caching of classifiers and policy tags at agents responsible for updating rules in access switches. Through our prototype and evaluation, we demonstrate that SoftCell significantly enhances both scalability and flexibility, within core networks.

V. REFERENCES

[1]. Gudipati A., Perry D., Li L. E., and Katti S., " SoftRAN : Software de- fined radio access network," in Proc.ACM HotSDN, 2013, pp. 25-30.

[2]. Jin X., Li L., Vanbever L., and Rexford J., " SoftCell: Scalable and flexible cellular core network architecture," in Proc. ACM CoNEXT, 2013, pp. 163– 174

Cite this article as :

Sathvik Reddy Thogaru, Harshitha Parupalli, Avanthika Makkena, "SoftCell: Scalable and Flexible Cellular Core Network Architecture", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 9, Issue 6, pp.255-260, November-December-2023. Available at doi : https://doi.org/10.32628/CSEIT2390637
Journal URL : https://ijsrcseit.com/CSEIT2390637