



presents



Open Talk Series

A series of illuminating talks and interactions that open our minds to new ideas and concepts; that makes us look for newer or better ways of doing what we did; or point us to exciting things we have never done before. A range of topics on Technology, Business, Fun and Life.

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Its not training. Its mind-opener.

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Mail OpenTalk@aditi.com with topic and availability.

HOW TO ENJOY AN TALK



Bring coffee & friends



Switch OFF mobile



Switch ON mind



Sign attendance sheet



SHARE your wisdom



QUESTION notions



THANK the Talker

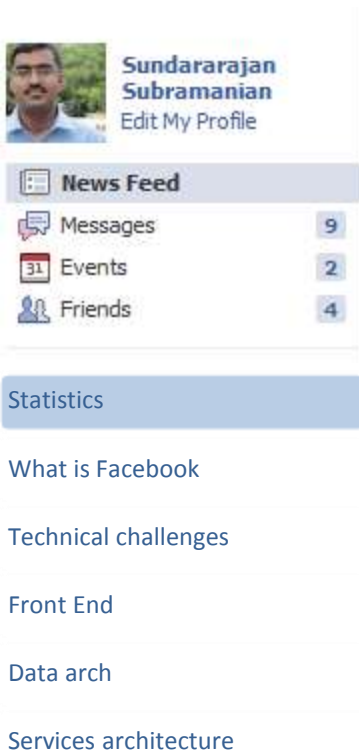


SPREAD the good word



Sundararajan Subramanian

facebook in 20 Minutes



- 2.7 M Photos
- 10.2M Comments
- 4.6 Messages
- Shared links: 1,000,000
- Tagged photos: 1,323,000
- Event invites sent out: 1,484,000
- Wall Posts: 1,587,000
- Status updates: 1,851,000
- Friend requests accepted: 1,972,000
- Photos uploaded: 2,716,000
- Comments: 10,208,000
- Message: 4,632,000

facebook in 20 Minutes



Statistics

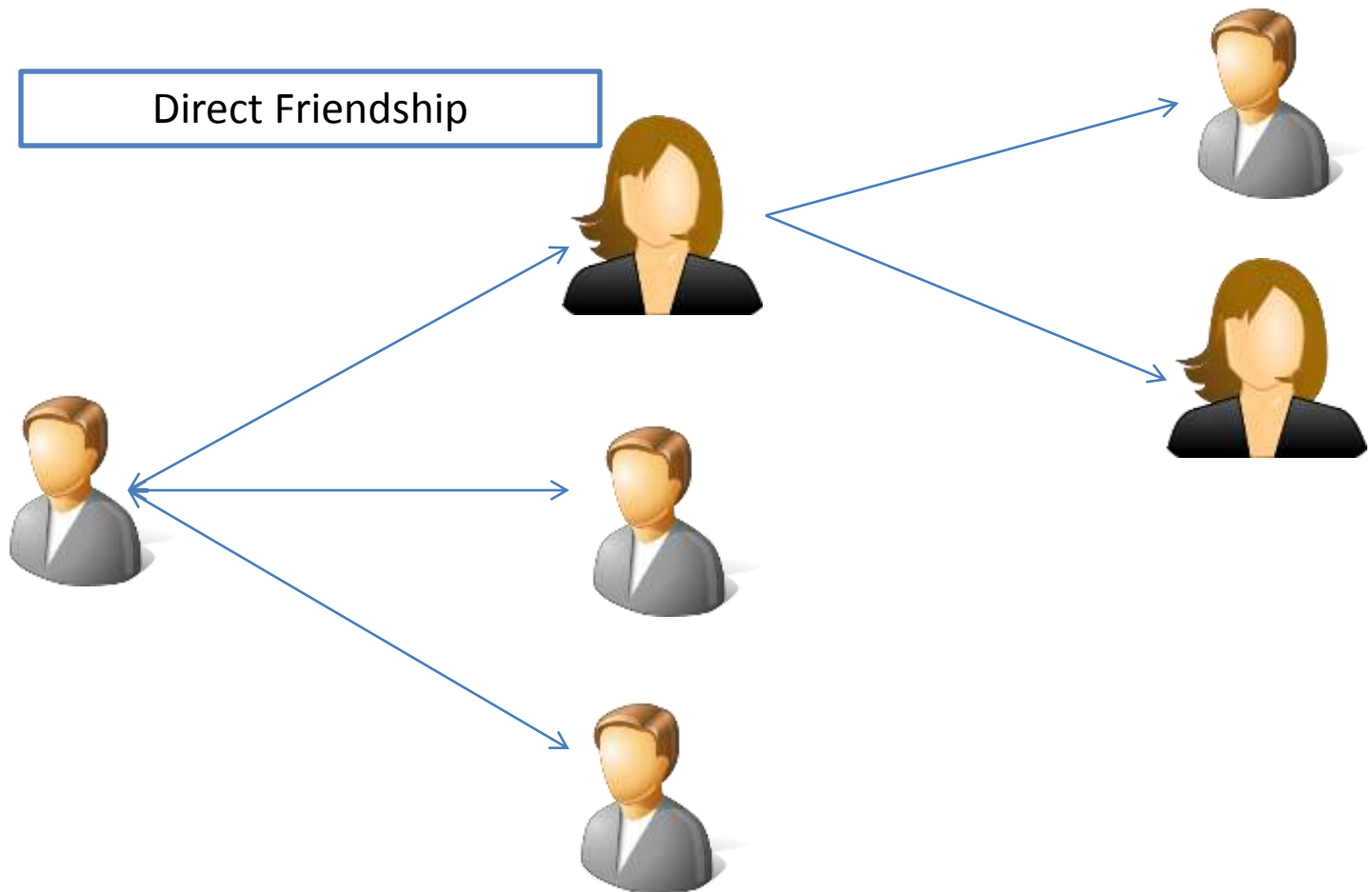
What is Facebook

Technical challenges

Front End

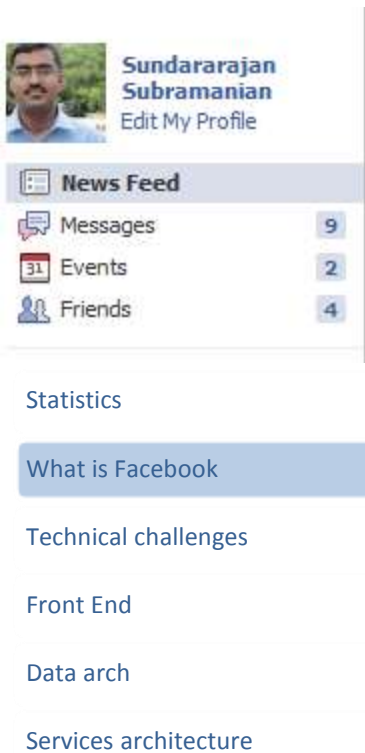
Data arch

Services architecture



Friends of Friends

What is facebook



- A social graph
- Friends , Friends of friends, somewhere in the network.
- Friends can comment, like, read your posts
- Friends of friends can just read
- Facebook messages – chat/ email/ SMS
- Near real-time updates

Technical Challenges



Statistics

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Challenges

- High Concurrency
- High Data Volumes
- Multilevel Hierarchical data

Ok to Live with

- Not Mission Critical
- Cached data is fine
- Write Failures are tolerable

The Data – (Illustrational)



Statistics

What is Facebook

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Everything is a hash lookup

User ID	Friends with	User Name	Age	Bio	Interests
1	2,3,4	XYZ
2	1

Challenges



☐ The Relational Nature of the data

☐ Data Volumes

☐ Concurrency

Solutions

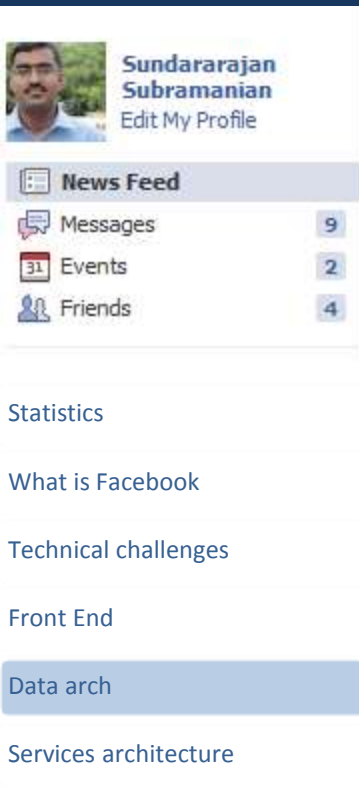


☐ No Constraints, No Joins in MySQL

☐ Write Through cache implementation

☐ Hash Ring based architecture

facebook – Data Partition initial thoughts



- Horizontal partitioning based on Networks.
 - Harvard
 - Stanford
 - Carnegie

facebook –Photos - HayStack



Statistics

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- Each File read required a minimum of 3 i/o in a typical file system
- CDNs- Not a Solution
- Haystack is a customized storage system, which minimizes the amount of File metadata and involves only 1 i/o for each file read.
- Haystack caches extensive data in its main memory

facebook – HayStack



Statistics

What is Facebook

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HayStack Interface

HayStack
Cache

HayStack
Directory

Logical Drives

Logical Drives

PD

PD

PD

PD

PD

PD

[http://CDN/Cache/Machine id/\(Logical volume, Photo\)](http://CDN/Cache/Machine id/(Logical volume, Photo))

Facebook – Serving the Photo - Haystack



Statistics

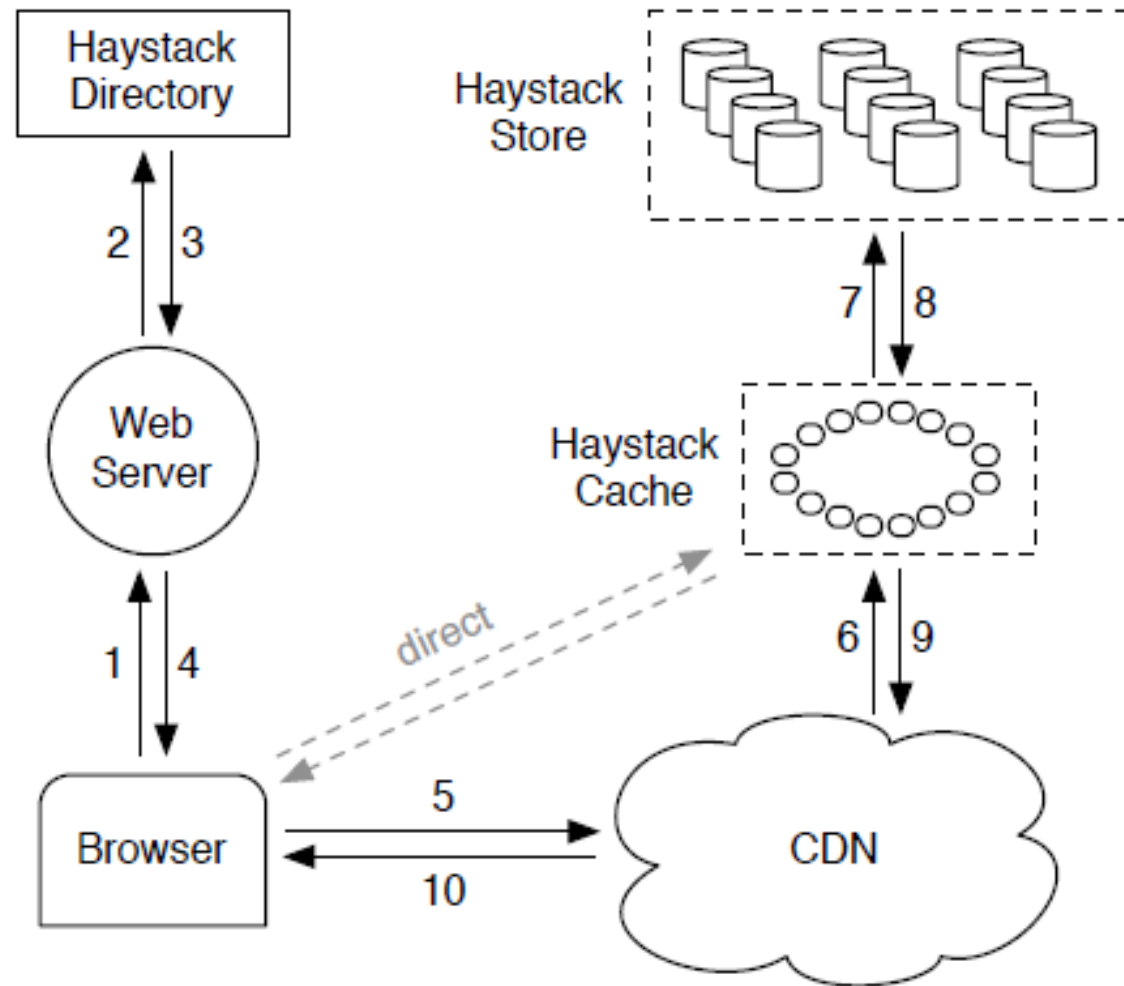
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Facebook – Scribe - Logging



Statistics

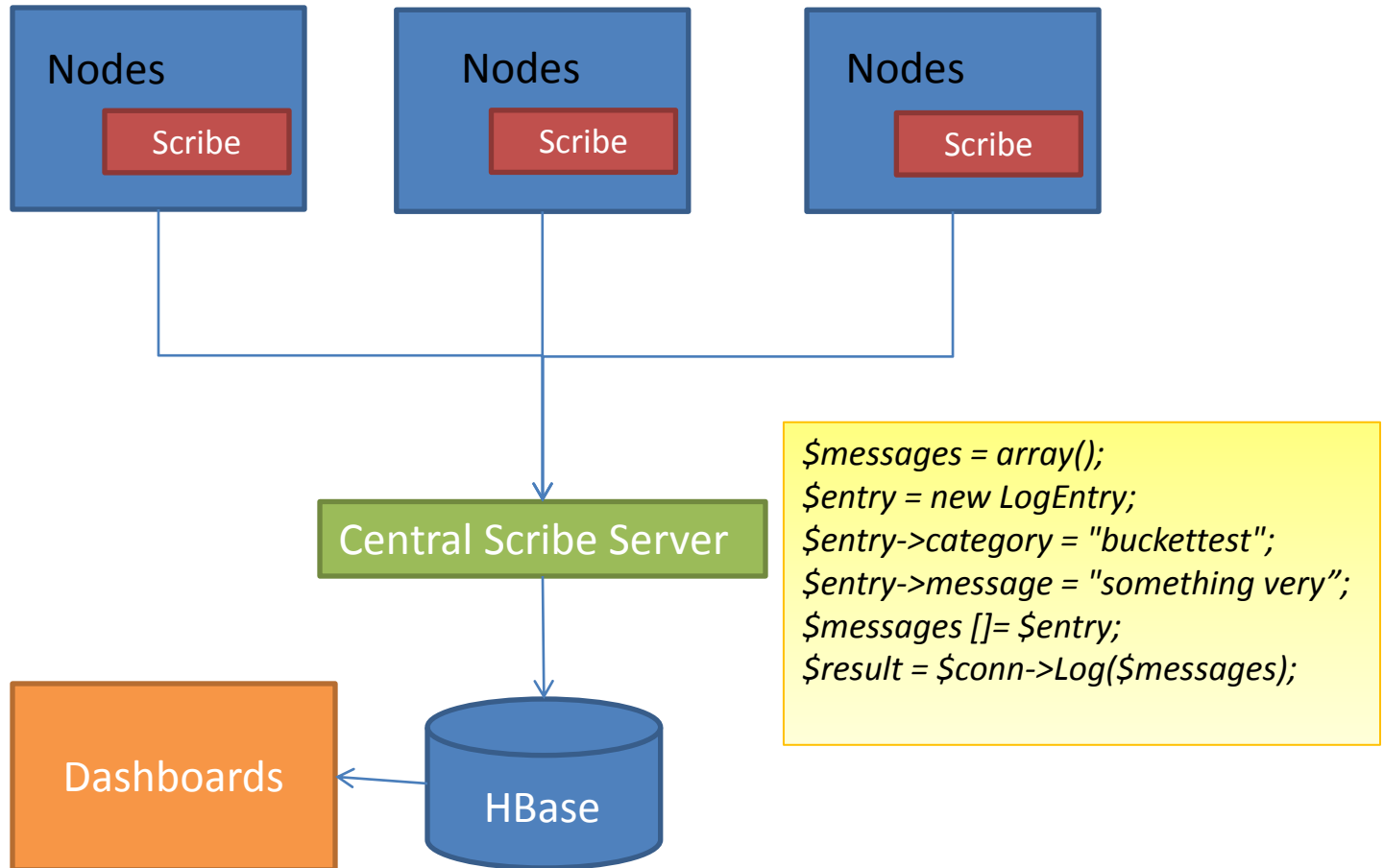
What is Facebook

Technical challenges

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facebook – Services– Thrift



Statistics

What is Facebook

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Services architecture

- Lightweight Software framework for cross-language development
- Dev need not worry about serialization , connection handling and threading
- Supported bindings:
 - C++, PHP, Python, java, ruby, erlang, perl, haskell
- Transports : Simple interface to i/o
- Protocols : Serialization format
 - TBinaryProtocol, TJsonProtocol
- Servers
 - Non Blocking, Async, Single threaded, multi-threaded

facebook – Memcache



Sundararajan
Subramanian
Edit My Profile



Statistics

What is Facebook

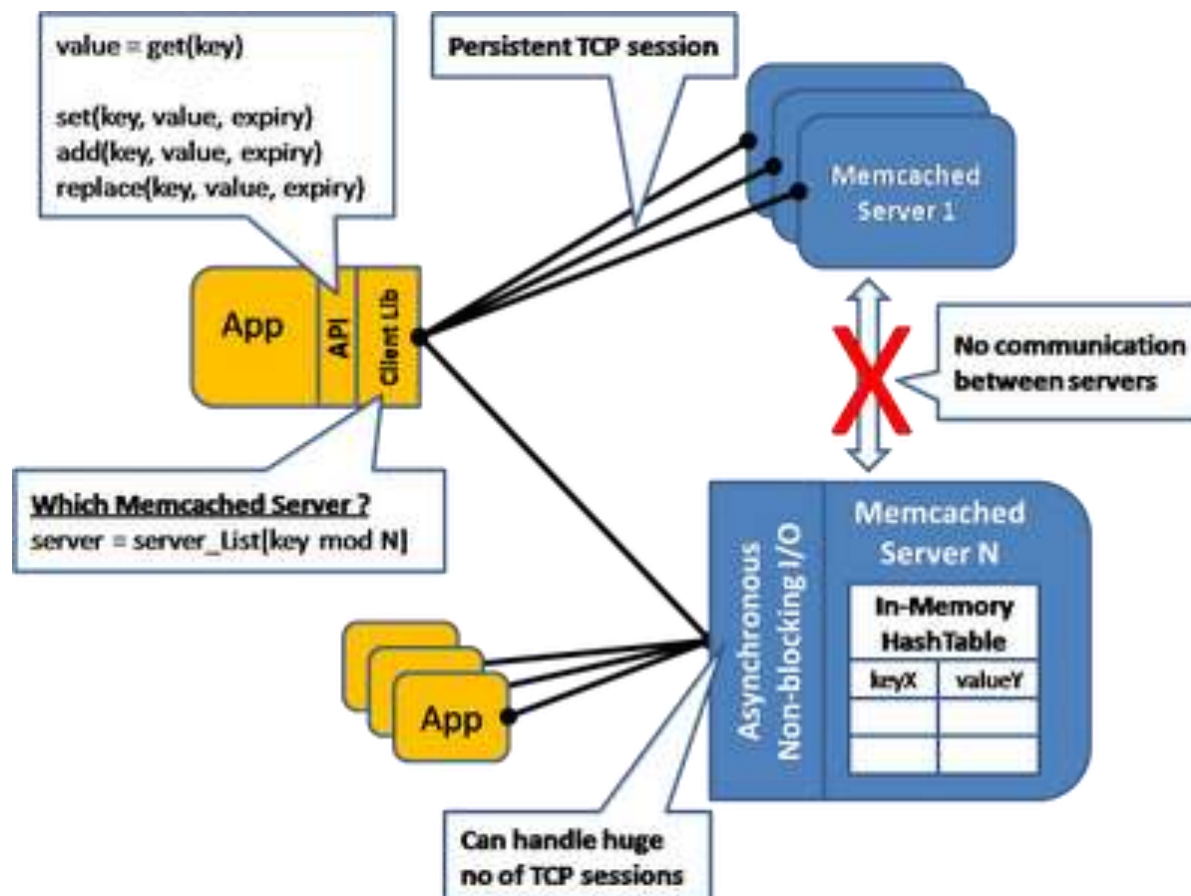
Technical challenges

Front End

Data arch

Services architecture

- In-memory distributed hash table
- “hot” data from MySQL stored in cache



facebook – front end - PHP



Statistics

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Technical challenges

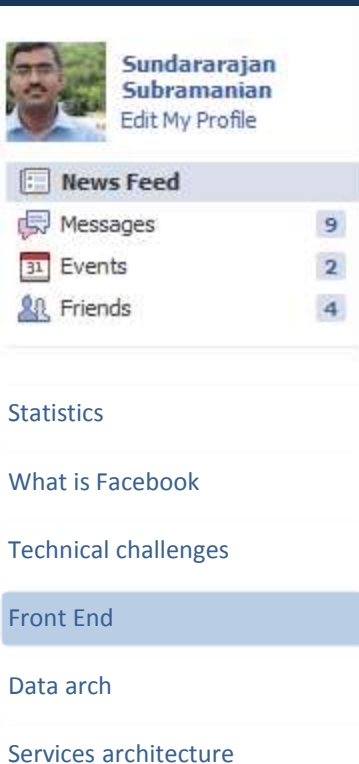
Front End

Data arch

Services architecture

- Op – Code Optimization
- APC improvements(alternate PHP cache)
 - Lazy Loading
 - Cache priming
- Custom Extensions
 - Memcache Client Extension
 - Serialization format
 - Logging, Stats Collection, Monitoring
 - Asynchronous event-handling mechanism

facebook – front end – Hip Hop



- Source Code Transformer
- Static Analysis, type inference, Code Generation
- Easier to write extensions
- Significantly cuts down on CPU and Memory usage

facebook – front end – Hip Hop



Sundararajan Subramanian
Edit My Profile

News Feed

Messages 9

Events 2

Friends 4

Statistics

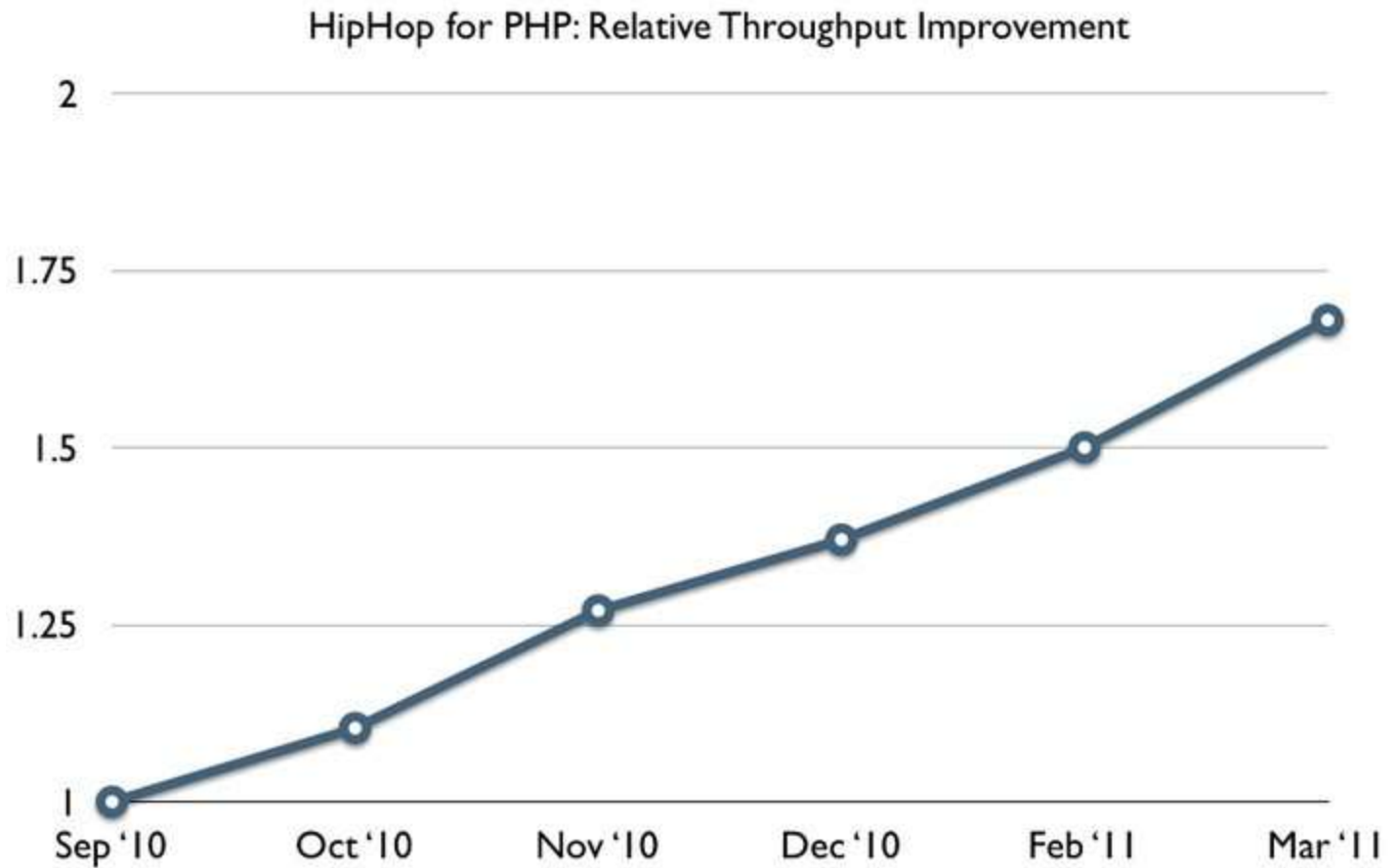
What is Facebook

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facebook – front end – BigPipe

BigPipe first breaks web pages into multiple chunks called pagelets



Sundararajan Subramanian
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The screenshot displays the Facebook front-end interface, which is composed of several distinct pagelets. On the left, a vertical sidebar contains the user's profile (Sundararajan Subramanian), navigation links (News Feed, Messages, Events, Friends), and a list of friends online. The main central area is the News Feed, which includes a search bar, a status update prompt, and a stream of posts from friends and pages. On the right, another vertical sidebar contains sections for Requests, Sponsored Ads, Events, and Get Connected. The interface is designed to be modular, allowing different components to be loaded or updated independently.

facebook Search Home Profile Account

News Feed Top News • Most Recent 213

What's on your mind?

Changhao Jiang Edit My Profile

News Feed

Messages

Events

Photos

Friends (10)

Applications

Games

Ads and Pages

Groups (5)

Local Pids

More

Friends Online

Christopher Palow

Eugene Letuchy

Hong Yan

Makinde Adeagbo

Mark Zudierberg

Roger Erdong Chen

Wayne Kao

Ke Yang

Venkat Venkataramani

Xin Qi

See All

Paul Saab it's out! <http://github.com/facebook/flashcache>
facebook's flashcache at master - GitHub
github.com
content
3 hours ago • Comment • Like • Share
Minghui Yang, Joydeep Sen Sarma, Boris Dimitrov and 18 others like this.
View all 4 comments

Mike Schroepfer @Paul/Mohan you guys should whip up a quick note about it.
about an hour ago

Ben Maurer - It'd be interesting to use ARC (http://en.wikipedia.org/wiki/Adaptive_replacement_cache) to automatically tune the dirty threshold. The ARC concept would need to be extended a bit (since a missed read is a bit different than a missed opportunity for write coalescing)
- Why did you choose FIFO as the policy for dealing with dirtying?
about an hour ago
Write a comment...

Steven Grimm

Shanghai's Back on Top of the World - TIME
www.time.com
For China's most dynamic, most cosmopolitan and sassiest city, this is a time to celebrate. After decades of hibernation following the founding of Mao Zedong's People's Republic in 1949, Shanghai is returning to its roost as a global center of commerce and culture.
8 hours ago • Comment • Like • Share

Facebook Engineering

Cultural Learnings from Russia: Engineering Version
I recently attended the RJT++ developer conference in Moscow where I was asked to give a talk on engineering culture at

Requests See All

9 friend requests

1 friend suggestion

5 group invitations

21 other requests

Sponsored Create an Ad

Try Facebook Ads ✕

Create an Ad

Reach the exact audience you want with Facebook's customizable targeting. Click here to learn more about advertising on Facebook.

Like

Events See All

Qiaozhu Mei's birthday Today

Jingshu Huang's birthday Monday

Xiong Zhang's birthday Monday

Julie Tung's birthday Tuesday

Get Connected

Who's on Facebook? Find your friends

Who's not on Facebook? Invite them now

Who's here because of you? Track your invites

Connect on the go Try Facebook Mobile

1 Chat (23)

facebook – front end – BigPipe



Statistics

What is Facebook

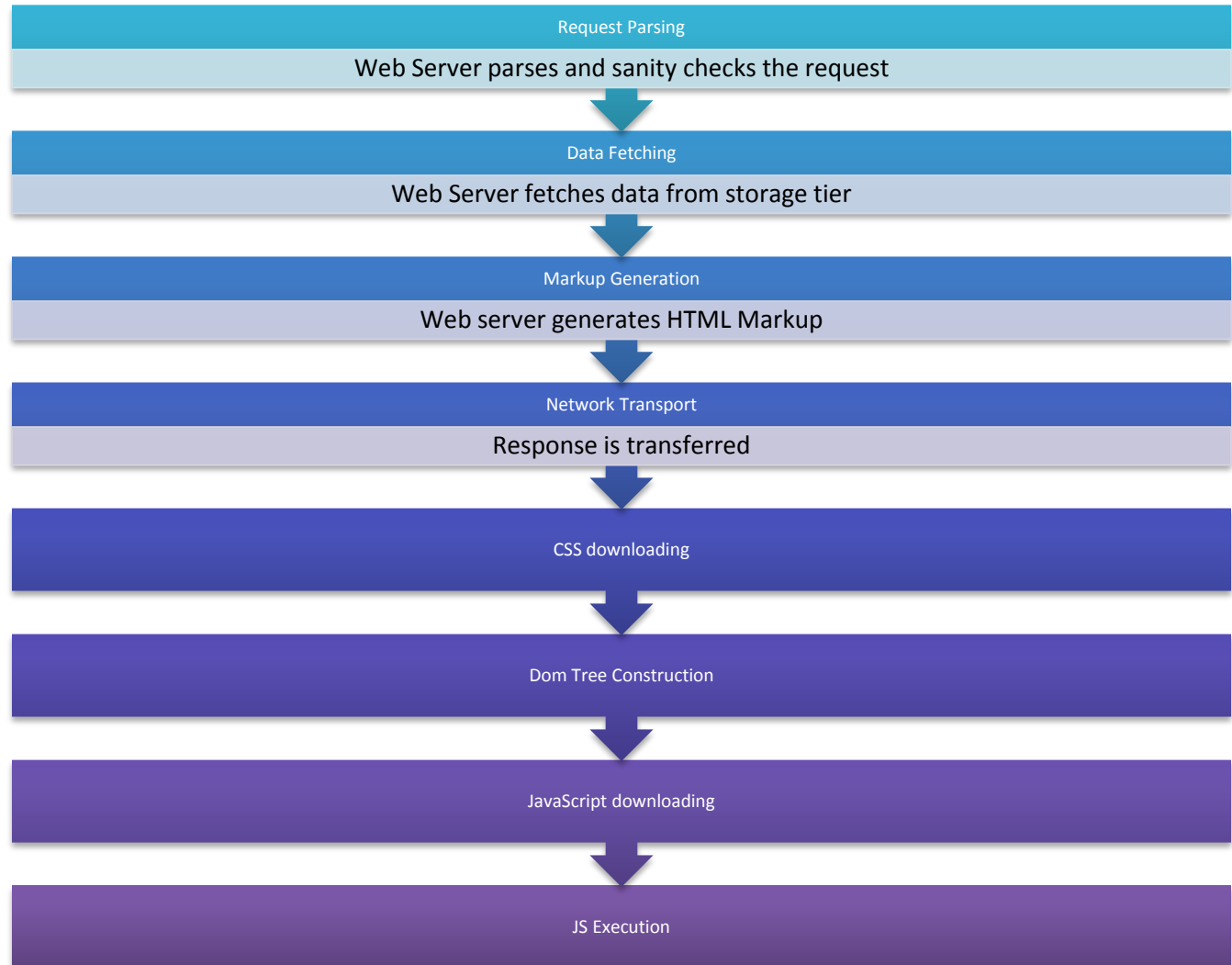
Technical challenges

Front End

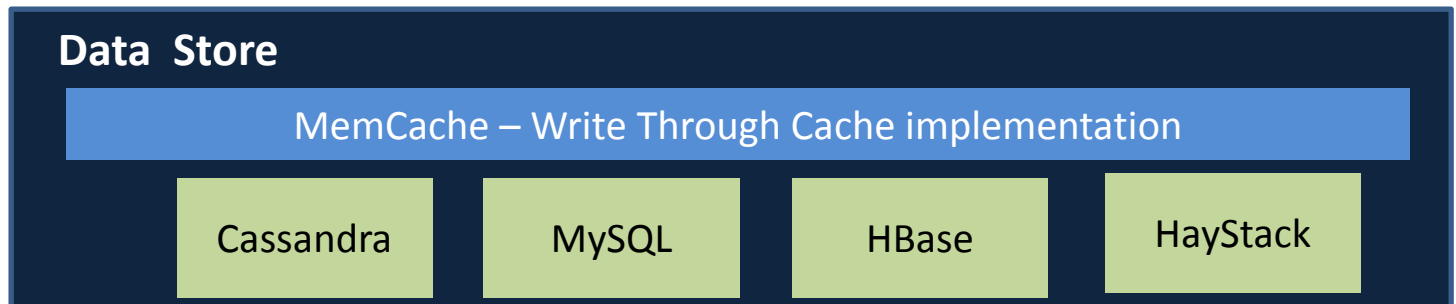
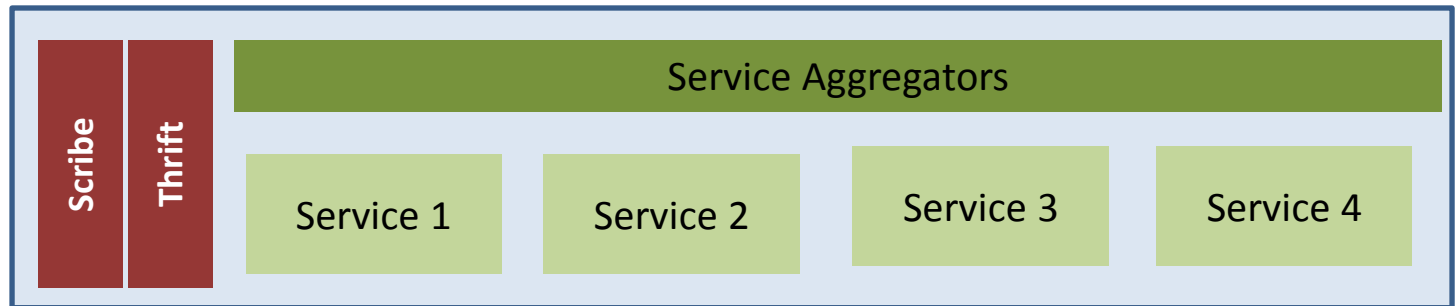
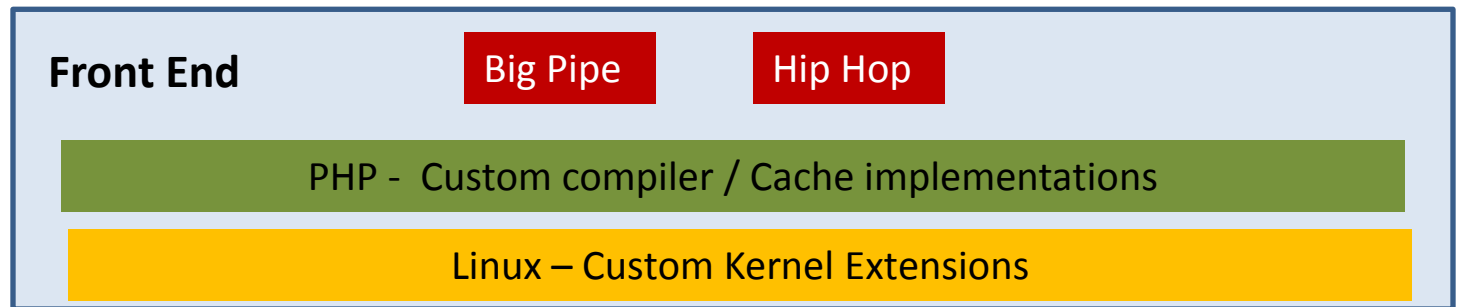
Data arch

Services architecture

BigPipe first breaks web pages into multiple chunks called pagelets



facebook – Technology Stack



facebook – Messages Infrastructure

 **Sundararajan Subramanian**
Edit My Profile

News Feed

-  Messages 9
-  Events 2
-  Friends 4

Statistics

What is Facebook

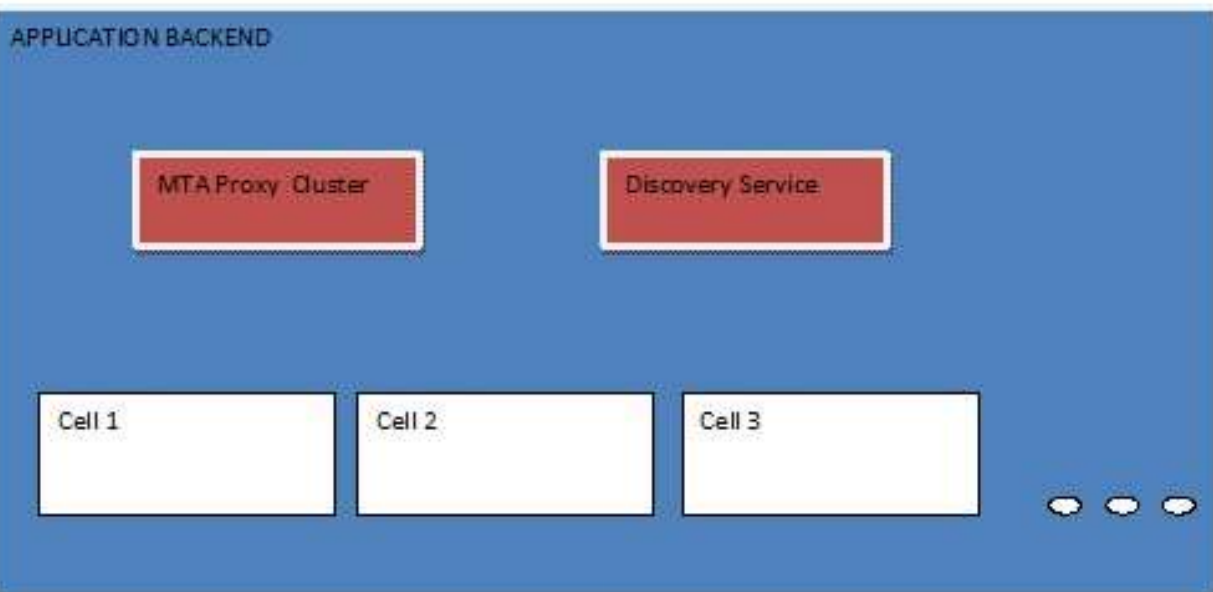
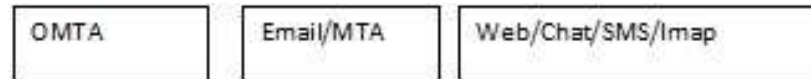
Technical challenges

Front End

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Services architecture

Messages



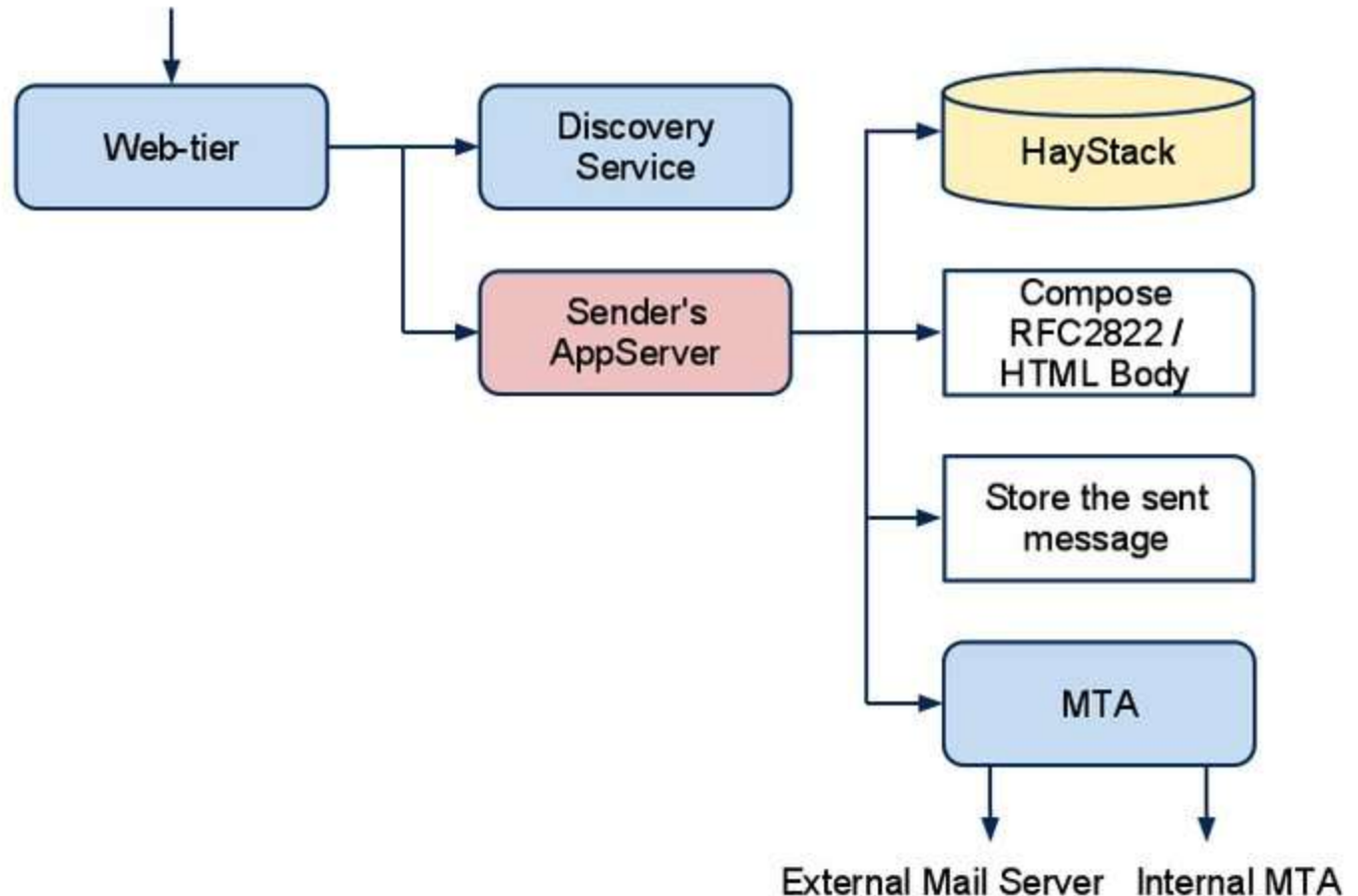
facebook - Messages



- Statistics
- What is Facebook
- Technical challenges
- Front End
- Data arch
- Services architecture
- Messages

Outgoing Flow

Create New Message / Reply



facebook - Messages



Sundararajan
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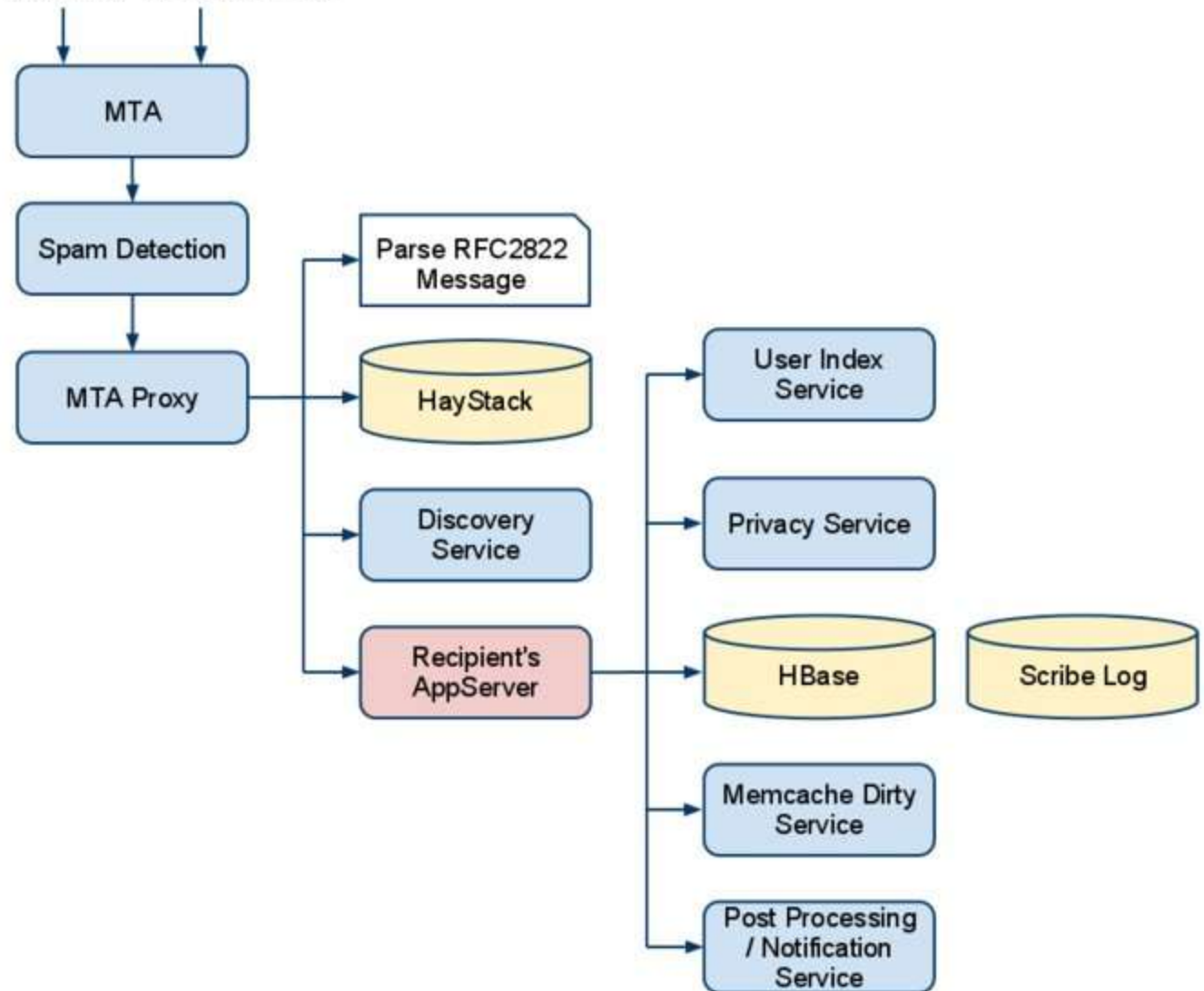
[Data arch](#)

[Services architecture](#)

[Messages](#)

Incoming Flow

External Email Internal Message



facebook – Cells



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[Edit My Profile](#)

News Feed

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What is Facebook

Technical challenges

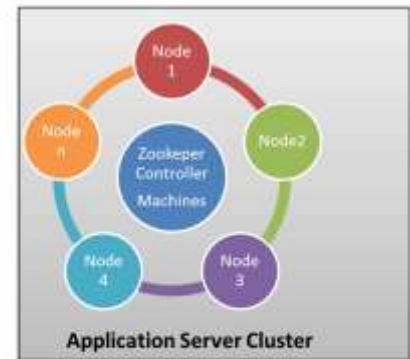
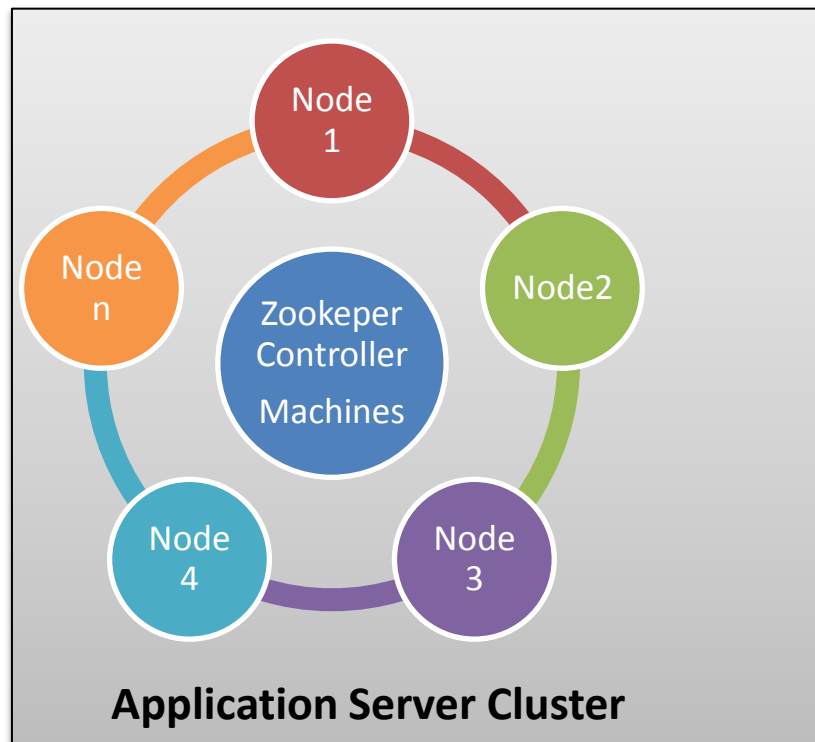
Front End

Data arch

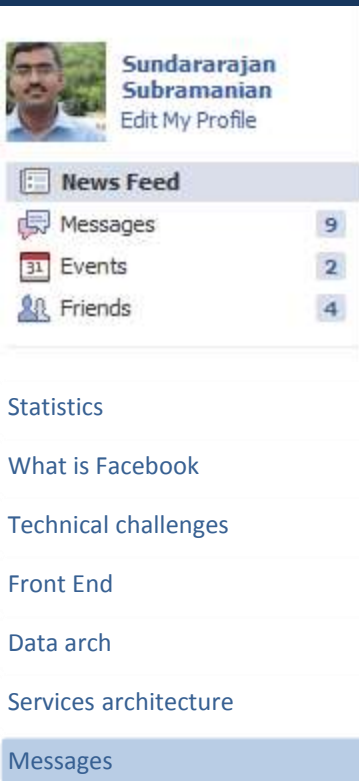
Services architecture

Messages

Cell



facebook – Cells



- They help scale incrementally while limiting failure scenarios
- Easy upgrades
- Metadata store failures affect only a few users
- Easy rollout
- Flexibility to host cells in different data centers with multi-homing for disaster recovery

Take away – for our applications



- Really parallel Asynchronous AJAX Pages
 - ASP.Net Update panels is a HOAX
- Appropriate usage of client side technology
- Cache – Cache – Cache
 - Write Through Caches are way better
 - App Fabric cache/ Memcache
- High – Normalization is not needed
 - Store denormalized views – materialized views
- Parallel Services and Service aggregators
- Fault tolerant applications
- Asynchronous Processing
- 1 Sec response time is too **SLOW**

References



- <http://facebook.com/engineering>
- www.infoq.com
- www.highscalability.com
- www.stackoverflow.com
- www.thrift.org

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Contact OpenTalk@aditi.com

