

# IU Next - IU Lakehouse

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## Goal

### Introduce Iceberg for all Hive tables in IU Hadoop (ultimately)

## Milestone

Phase	Milestone	IU user can
1	⚠ <a href="#">IUNEXT-28</a> - Jira issue doesn't exist or you don't have permission to view it.	<ul style="list-style-type: none"> <li>Start creating Iceberg table in IU Hadoop.</li> <li>Get a table management system support for IU Iceberg table to reduce human cost for table management operation.</li> </ul>
<b>2023/9/1</b>		
2	⚠ <a href="#">IUNEXT-43</a> - Jira issue doesn't exist or you don't have permission to view it.	<ul style="list-style-type: none"> <li>Start using Iceberg tables for their own queries.</li> <li>Start migrating user-side workload into Iceberg.</li> </ul>

## Overview

### Background objective

Through this project, we can achieve "**right to be forgotten**" by mitigating multiple risks that LINE faces for data management, related to privacy policy and domestic/international law of personal information.

Mitigated risk	Current problem & background	Resolution	Business Impact

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## Project information

Opera	<a href="https://opera.linecorp.com/projects/E000090960">https://opera.linecorp.com/projects/E000090960</a>
Initiative	<p>⚠ <a href="#">IUNEXT-28</a> - Jira issue doesn't exist or you don't have permission to view it.</p> <p>⚠ <a href="#">IUNEXT-43</a> - Jira issue doesn't exist or you don't have permission to view it.</p>

Mitigated risk	Current problem & background	Resolution	Business Impact
IU can perform <b>partial removal/update for any data</b> in IU Hadoop with a reasonable cost.	<ul style="list-style-type: none"> <li>IU users mistakenly store high risk data set into IU.           <ul style="list-style-type: none"> <li>By renewal of any law of personal information</li> <li>By changing privacy policy</li> <li>By overlooking in development/QA phase</li> </ul> </li> <li>"Apache Hadoop" doesn't support efficient partial removal/update natively.           <ul style="list-style-type: none"> <li>It only achieves it by "writing all data", which makes unnecessary data IO.</li> <li>This makes an operation time very longer - not efficient.</li> </ul> </li> </ul>	Introduce " <b>Delta File</b> " architecture into IU Hadoop to support row/column-level deletion/updating	<ul style="list-style-type: none"> <li>IU Lakehouse will reduce LINE's operational cost for removing/updating partial data.</li> <li>IU Lakehouse will improve handling speed faster when a service finds any sensitive data storing.</li> </ul>
IU can improve a <b>flexibility of data schema</b> definition.	<ul style="list-style-type: none"> <li>IU core query engine - Apache Hive has some restrictions of schema changing.           <ul style="list-style-type: none"> <li>Poor support when column deleting/replacing</li> <li>No support to change partition key, which requires entire data recreating</li> </ul> </li> </ul>	Introduce " <b>Schema Evolution</b> " feature to keep backward compatibility when schema changing	<ul style="list-style-type: none"> <li>IU Lakehouse will provide system separation between metadata and storage.</li> <li>IU Lakehouse will improve service development speed faster.</li> <li>IU Lakehouse will keep previous data compatibility before/after schema changing.</li> </ul>
IU can reduce operational cost to sustain inactive OSS, and <b>focus on more productive data system</b>	<ul style="list-style-type: none"> <li>IU core query engine - Apache Hive's community recently became slow development speed.           <ul style="list-style-type: none"> <li>Slow bug fixing &amp; feature release, comparing to other engines like Trino/Spark</li> </ul> </li> <li>IU central catalog system - Hive metastore is sometimes critical performance bottleneck for IU user's workload.</li> <li>Hive based catalog system tightly connects its metadata to storage system.</li> </ul>	<b>Redesign catalog management system</b> based on Iceberg table format to escape Apache Hive world	<ul style="list-style-type: none"> <li>IU Lakehouse will mitigate future risk related to Apache Hive.</li> <li>IU Lakehouse will reduce business/system dependency of certain vendor.</li> <li>IU Lakehouse will improve system performance related to IU comparing to Hive.</li> </ul>

## Target users

All IU users

## Scope

Period	2023/4 ~ 2024/9
Owner	@okdtsk - Okuda Tasuku[ 奥田輔 ]
<b>Communication/Tools</b>	
Slack	#pj_iu_lakehouse
Slack	#tech_iu_lakehouse
Slack	#pj_iu_next
Box	Invalid credentials. <a href="#">Sign in</a> to access Box Folder
Miro	Miro IU Lakehouse project

## Stakeholders

### Project members

Name	Role	MM
@okdtsk - Okuda Tasuku[ 奥田輔 ]	Project Owner	0.3MM
@Ono Takeshi[ 尾野健 ]	Technical leader	0.5MM
@Osuka Atsutoshi[ 大須賀敦俊 ]	Sub technical leader	0.5MM
@hilmi[ アルファティヒルミ ]	Developer	0.5MM

### Non project members

- Data
  - All IU hive tables
  - IU Archiving **NEED TO BE DISCUSSED**
- Operation
  - Support Iceberg table usage for all IU users
  - Provide guideline for IU user's migration

## Out of Scope

- Data
  - IU Logsearch
- Operation
  - User table/workload migration

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## Requirement

### Functional requirement

**TBD**

### Non-functional requirement

**TBD**

Name/Organization	Role
IU Dev team	Phase 1: Develop IU Web "Iceberg meta reader"
IU Hadoop team	Phase 1: Prepare hvieserver2 for Iceberg
Data Solution team	Phase 2: Support migration

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## Children pages

- ▼ [IU Lakehouse - Design Docs](#)
  - [IU Lakehouse - Orc Converter for Iceberg](#)
- ▼ [IU Lakehouse - Meetings](#)
  - [2023-03-14 IU Lakehouse - Weekly Meeting](#)
  - [2023-03-28 IU Lakehouse - Weekly Meeting](#)
- ▼ [IU Lakehouse - Outdated](#)
  - [IU Next - IU Lakehouse - Proposal](#)
- ▼ [IU Lakehouse - Project Convention](#)
  - [IU Lakehouse - IULH JIRA Customization Format](#)
- ▼ [IU Lakehouse - Research](#)
  - [IU Lakehouse - Proposal - Fix iceberg-spark to support Timestamp w/o Timezone](#)

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## References

### Internal

- [IU Next 2022 - Design doc - Lakehouse](#)
- [2022-10 Introduction to Apache Iceberg](#)
- [Catalog-based access control with parallel read/write capabilities](#)
- [DE - Meetup Status of Iceberg in IU](#)
- [IU Web - Planning - Support Iceberg table](#)
- [UTS Data Pipeline - Iceberg - Table Spec](#)
- [IU Dev - IU Web support Iceberg](#)

### Meetings

- [20230309 - iceberg情報共有会 DSC x DP](#)

## External

- <https://tabular.io/blog/rest-catalog-docker/>

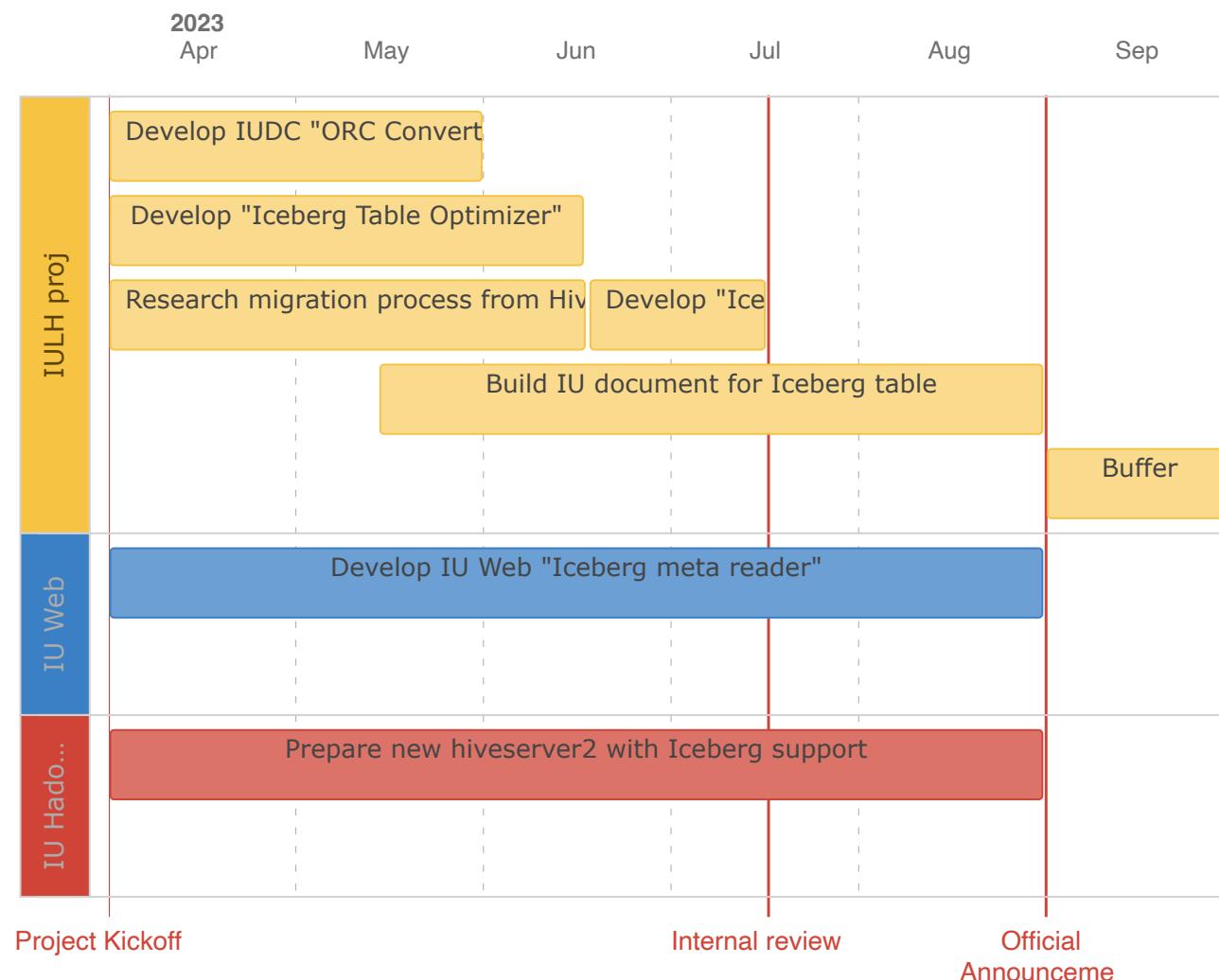
# MM & Schedule

## Schedule

Details: <https://bts.linecorp.com/secure/PortfolioPlanView.jspa?id=597&sid=611&vid=2144#plan/backlog>

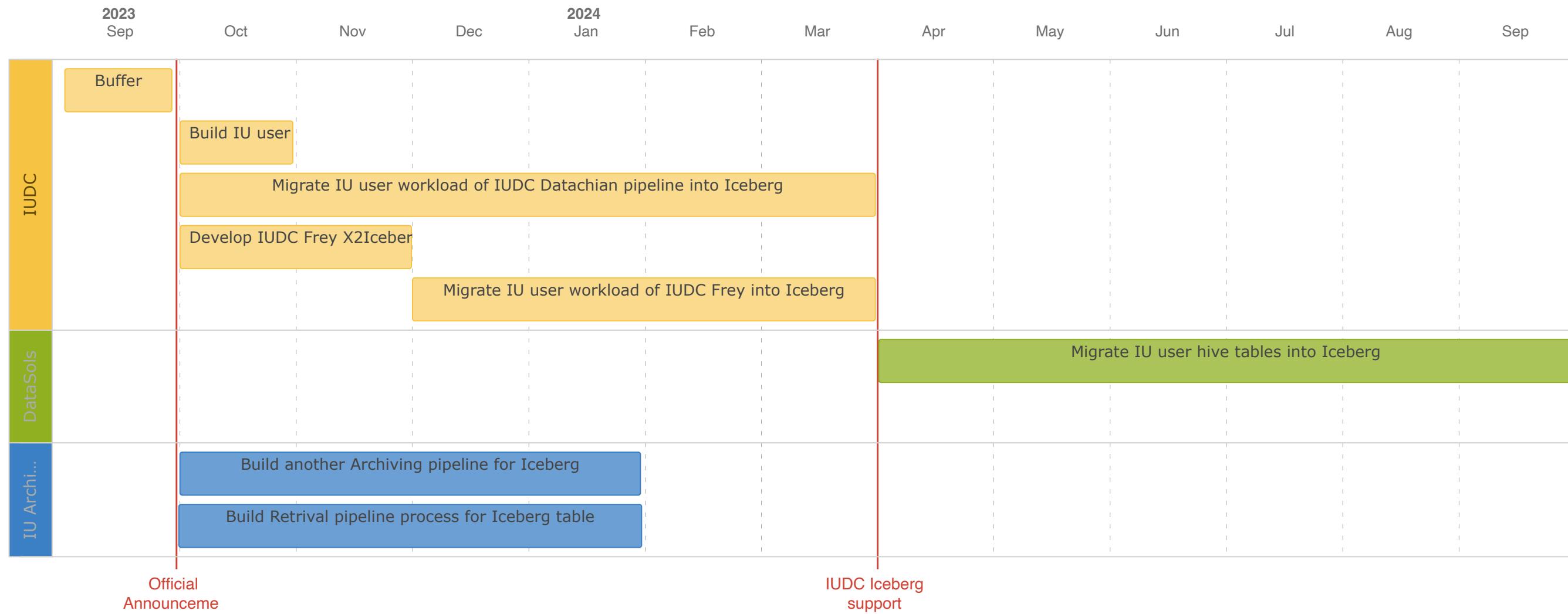
**⚠ IUNEXT-28 - Jira issue doesn't exist or you don't have permission to view it.**

Period: 2023/4 - 2023/8



**⚠ IUNEXT-43 - Jira issue doesn't exist or you don't have permission to view it.**

Period: 2023/10 - 2024/9



## MM plan

Appx. Yearly MM = 1.8MM

Detail: [IUDC - MM planing for FY23#MMforpredefineprojects](#)

## Cost Reduction Estimation

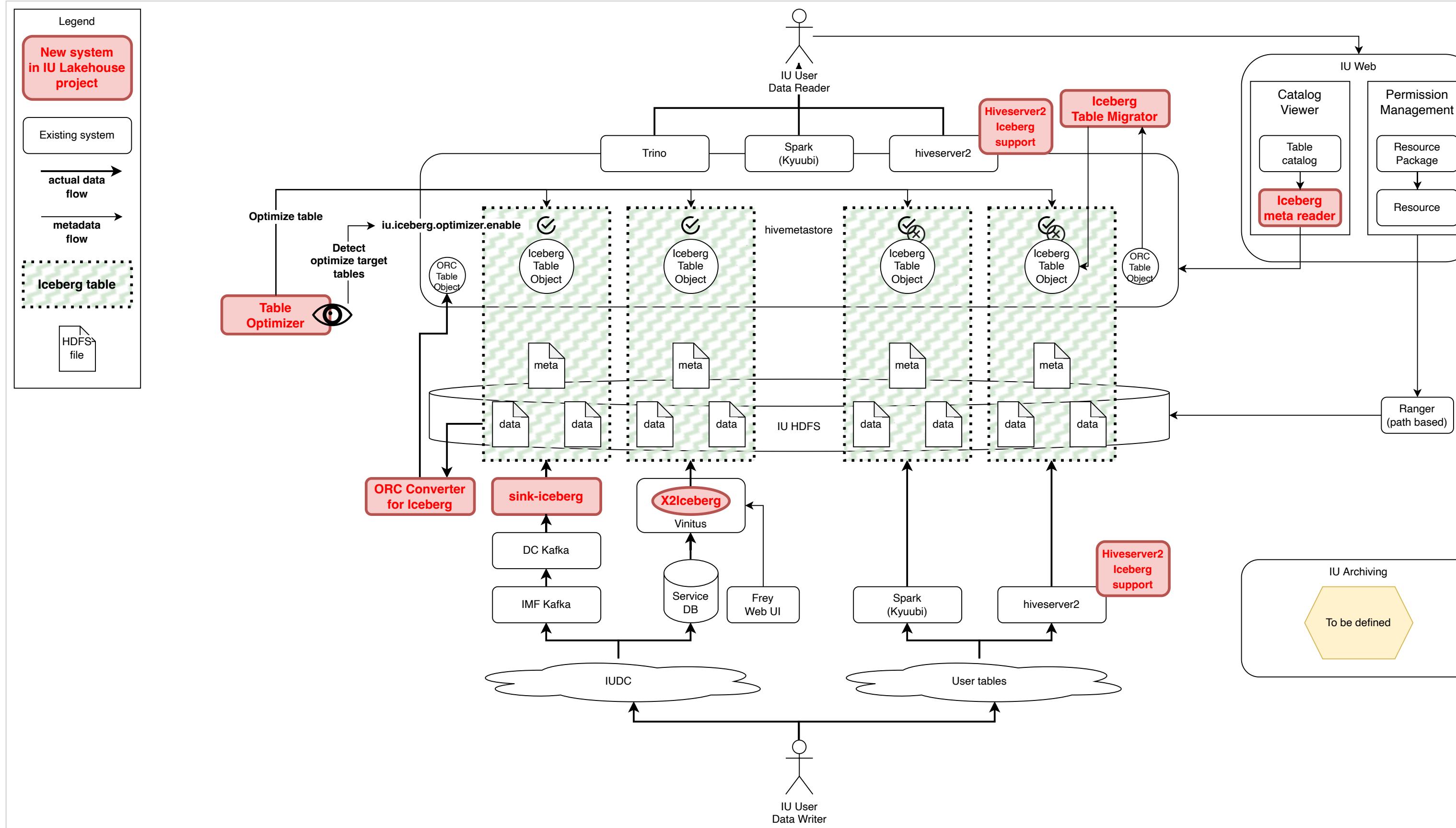
	Overview	Detail
<b>Current cost</b>	45 hours / request (=6 MD * 7.5 hours)	<ul style="list-style-type: none"> <li>Time cost <ul style="list-style-type: none"> <li>To perform this partial deletion/updating, 2~3 hours at least.</li> <li>For some big data/time range, it will become more - multiple days, sometimes months.</li> </ul> </li> <li>Human cost <ul style="list-style-type: none"> <li>IU sysadmin: 4MD for co-operation, 1.5MD for discussing/reviewing this process</li> <li>Service side: 0.5MD for discussing/reviewing this process</li> </ul> </li> </ul>
<b>Future cost reduction objective</b>	90 hours (= 1.8 MM * 20 months * 150 hours / 60 months)	

## Project risk

Risk	Mitigation plan & Side effect
Hivemetastore integration issue as an Iceberg catalog <ul style="list-style-type: none"> <li>• Unexpected behavior when accessing/managing Iceberg table through hivemetastore</li> </ul>	1. Develop Iceberg REST API <ul style="list-style-type: none"> <li>• Extend Tier1 period to put new development task</li> <li>• Reschedule Tier2~</li> </ul>
Cloudera development speed of CDP Hive Iceberg support patch <ul style="list-style-type: none"> <li>• Cloudera's Hive patch is behind a schedule we expect</li> </ul>	1. Start user Iceberg table support without hive access pattern <ul style="list-style-type: none"> <li>• No full set support of IU access pattern</li> <li>• User complain expected</li> <li>• Readjust Project KPI &amp; schedule</li> </ul> 2. Reschedule the date of ready-for-migration <ul style="list-style-type: none"> <li>• Readjust Project KPI &amp; schedule</li> </ul>
Side effect of CDP Hive Iceberg support patch <ul style="list-style-type: none"> <li>• No acceptable level of compatibility between Hive table and Iceberg table even after applying Hive Iceberg support</li> </ul>	1. Start user Iceberg table support without hive access pattern <ul style="list-style-type: none"> <li>• No full set support of IU access pattern</li> <li>• A lot of user complain</li> <li>• Readjust Project KPI &amp; schedule</li> </ul> 2. Reschedule the date of ready-for-migration <ul style="list-style-type: none"> <li>• Readjust Project KPI &amp; schedule</li> </ul>
User migration speed of Iceberg table <ul style="list-style-type: none"> <li>• Iceberg migration strongly depends on user-side schedule, which sometimes have huge delay we expect</li> <li>• This process requires result checking of queries by user side, or sometimes rewrite them</li> </ul>	1. Provide user guideline of Iceberg table usage
IU HDFS capacity issue during IUDC Datachain Iceberg migration <ul style="list-style-type: none"> <li>• During this migration, both data of ORC and Iceberg will be kept in IU HDFS</li> </ul>	1. Adjust Phase2 "Drop ORC Table" schedule more earlier <ul style="list-style-type: none"> <li>• User complain expected</li> <li>• We should estimate current situation               <ul style="list-style-type: none"> <li>◦ how many hive workload for mission critical</li> <li>◦ how many data if we put both data</li> </ul> </li> </ul> 2. Discuss another approach? <ul style="list-style-type: none"> <li>• No clear feasibility</li> </ul>
"Iceberg meta reader" in IU Web will be delayed to release, due to a lack of engineering resource in IU Dev team and priority adjustment.	<b>TBD</b>

## Architecture

### IU Iceberg support system



## Spec Doc

System name	PIC	Detail
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System name	PICT	Detail
<b>sink-iceberg</b>	IU Lakehouse + Datachian dev	<p><a href="https://git.linecorp.com/takeshi-ono/sink-iceberg">https://git.linecorp.com/takeshi-ono/sink-iceberg</a></p> <p>Already deployed into production env as of 2023/3/8</p>
<b>table-optimizer</b>	IU Lakehouse	<p><b>TBD</b></p> <ul style="list-style-type: none"> <li>Features <ul style="list-style-type: none"> <li>To scan hivemetastore periodically to list all Iceberg table in a target of table-optimizer</li> <li>For each Iceberg table <ul style="list-style-type: none"> <li>Delete old snapshot</li> <li>Delete Orphan file</li> <li>Proceed compaction</li> <li>Re-create manifest files</li> </ul> </li> </ul> </li> <li>Target data <ul style="list-style-type: none"> <li>v1: Only IUDC data</li> <li>v2: All Iceberg tables including IU user managed ones</li> </ul> </li> <li>Discussion point <ul style="list-style-type: none"> <li>How to detect target Iceberg tables efficiently</li> <li>How often table-optimizer optimizes Iceberg tables</li> <li>How to treat last access time to avoid side effect to IU Archiving</li> <li>How to treat HDFS file owner to avoid unexpected permission changes</li> </ul> </li> </ul>
<b>ORC Converter for Iceberg</b>	IU Lakehouse	<p><b>TBD</b></p> <ul style="list-style-type: none"> <li>Features <ul style="list-style-type: none"> <li>List target tables from datachain-tables (or hivemetastore?)</li> <li>Create ORC tables from Iceberg tables</li> </ul> </li> </ul>
<b>X2iceberg</b>	IU Lakehouse + Frey dev	<p><b>TBD</b></p> <ul style="list-style-type: none"> <li>One of vinitus job types</li> <li>Types <ul style="list-style-type: none"> <li>single_mysql2iceberg</li> <li>multi_mysql2iceberg</li> <li>mongodb2iceberg</li> </ul> </li> <li>Discussion point <ul style="list-style-type: none"> <li>When we can start our development of single_mysql2iceberg? (need to discuss with Vinitus)</li> <li>How to treat old data set?</li> <li>How to proceed migration process? (switch or double-write?)</li> </ul> </li> </ul>
<b>Iceberg table migrator</b>	IU Lakehouse	<p><b>TBD</b></p> <ul style="list-style-type: none"> <li>Discussion point <ul style="list-style-type: none"> <li>Which is good migration method? <ul style="list-style-type: none"> <li>in-place</li> <li>shadow</li> </ul> </li> </ul> </li> <li>Links <ul style="list-style-type: none"> <li><a href="https://www.dremio.com/blog/how-to-migrate-a-hive-table-to-an-iceberg-table/">https://www.dremio.com/blog/how-to-migrate-a-hive-table-to-an-iceberg-table/</a></li> </ul> </li> </ul>

System name	PIC	Detail
<b>IU Web Iceberg meta reader</b>	IU Dev team	<p><b>TBD</b></p> <ul style="list-style-type: none"> <li>Features <ul style="list-style-type: none"> <li>Show proper partition keys in IU Web Catalog view from Iceberg metadata files (manifest)</li> </ul> </li> <li>Links <ul style="list-style-type: none"> <li><a href="#">2022-10 Introduction to Apache Iceberg#202210IntroductiontoApacheIceberg-Todo</a></li> </ul> </li> </ul>
<b>CDP Hive Iceberg support</b>	Cloudera + IU Hadoop team	<p><b>TBD</b></p> <ul style="list-style-type: none"> <li>Discussion point <ul style="list-style-type: none"> <li>When we can get a patch of Hive Iceberg support from Cloudera? <ul style="list-style-type: none"> <li>How to proceed its quality check?</li> </ul> </li> </ul> </li> </ul>
<b>IU Archiving Iceberg support</b>	<p>IU Lakehouse for policy</p> <p>IU Archiving for actual pipeline development</p>	<b>TBD</b>

No labels

## 1 Comment



[okdtsk - Okuda Tasuku\[ 奥田輔 \]](#)

Need to consider

- More easy-understanding summary for "Background Objective" to negotiate broader stakeholders
- IU Archiving integration
- Collaboration with Cloudera, especially about Hiveserver2 Iceberg support
- Migration co-working with DataSols for IUDC pipeline
- How to describe "building migration plan" in Phase1
- Out of scope: Trino Presto support (in progress as of 2023/4/3)
- OASIS integration