Development of the Datset Searcher Webapp for finding data on the Belle II computing grid

David Dossett, Kim Smith & Martin Sevior
University of Melbourne, CHEP2019

Belle II

THE UNIVERSITY OF MELBOURNE

Introduction

As Belle II data production continues throughout the this and the following years, the number of analysts requiring access to both real and monte-carlo data will increase dramatically. With this in mind, it becomes essential that physicists are able to locate data of interest in an intuitive and efficient manner. Otherwise, what was once an inconvenience will escalate into a serious hinderance.
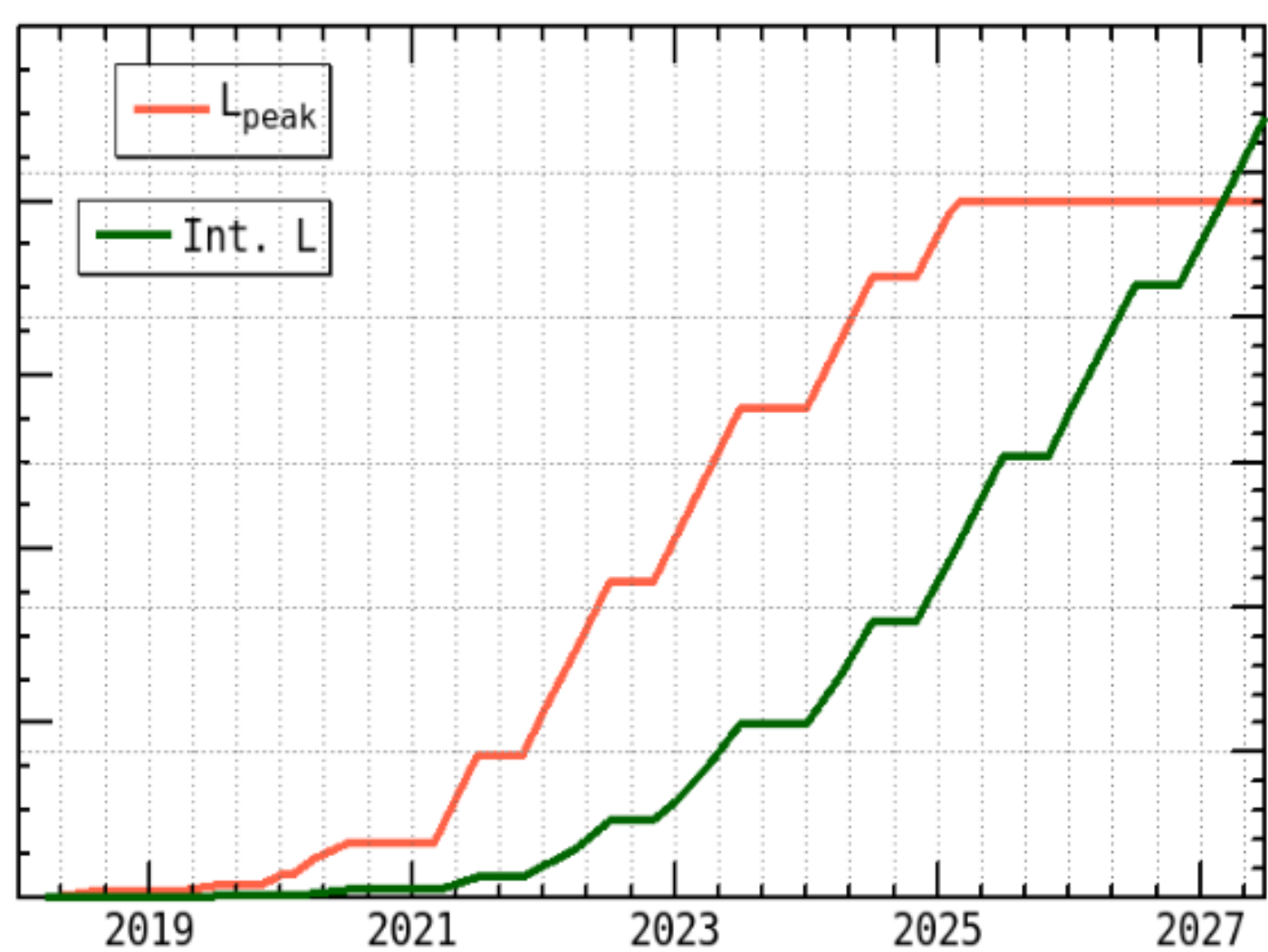

The Current System

• Belle II data is stored on a computing grid across many storage elements (SE) around the world.

• Logical path names (LPN) and their metadata are stored in the AMGA database while their locations on the SEs are tracked by the logical file catalogue (LFC).

• Software tools for working on the grid are hosted by the DIRAC software framework with a custom subsystem created for the special needs of the Belle II experiment called BelleDIRAC.

• File replication and transference is handled by the distributed data management system (DDM).
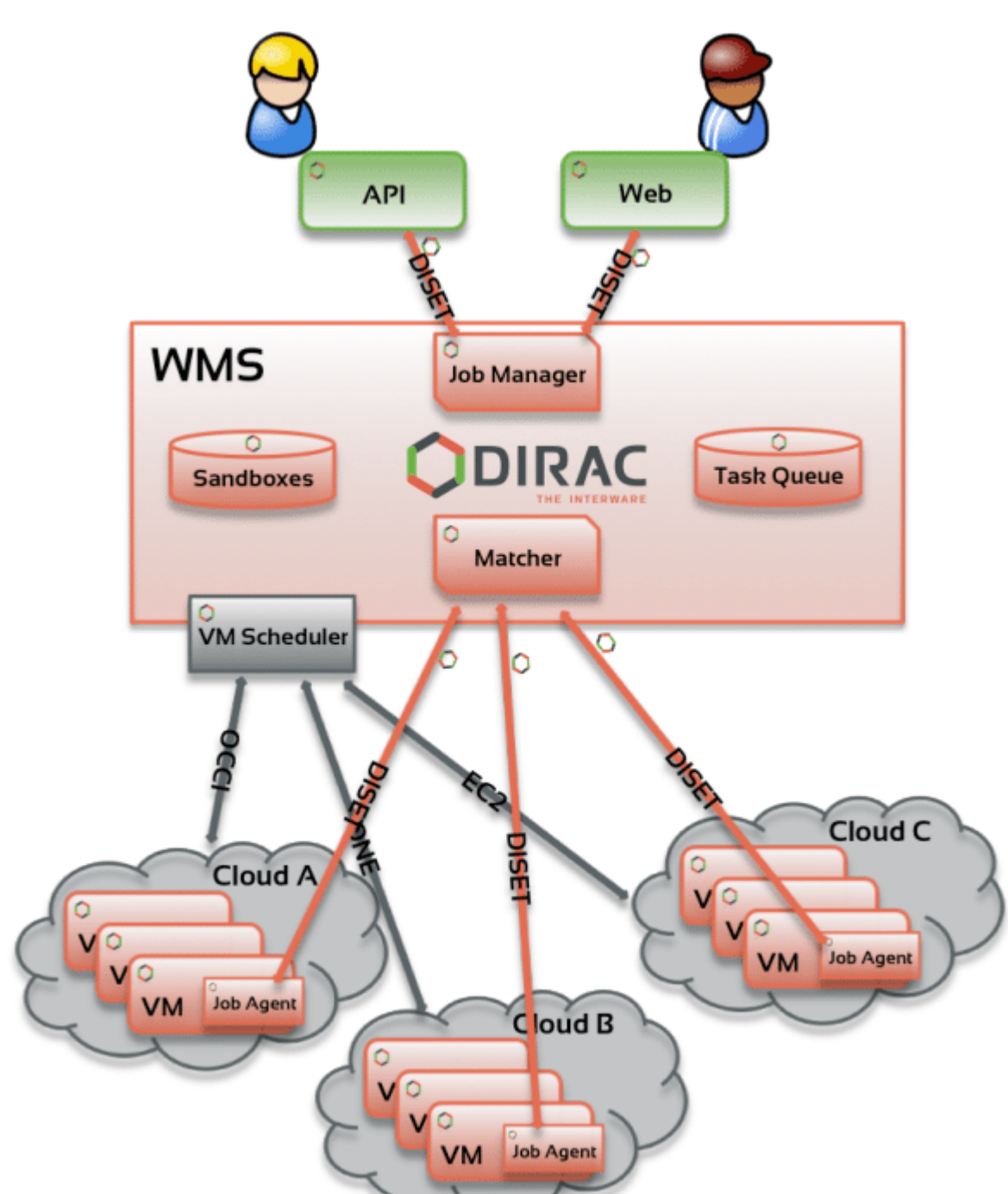
Tsaregorodtsev, A.. (2014). DIRAC distributed computing services. Journal of Physics: Conference Series. 513. 10.1088/1742-6596/513/3/032096.

End Users

The Problems

This system has several issues which make it nonideal for managing and accessing data.

• The AMGA database is primarily designed for attaching metadata to LPNs and retrieving it back again given the LPN. The task of querying metadata for matching LPNs is not well supported.

• Due to the difficulty of finding LPNs from metdata, much of it has been encoded into the LPNs itself. This has the side effect of making them much longer, which in turn makes storing them in DIRAC and MySQL tables problematic.

• The only way for users to find the locations of data on the grid is by manually searching through large tables maintained in the Belle II internal wiki. This creates a large amount of overhead in the form of constant updates as new data is produced.
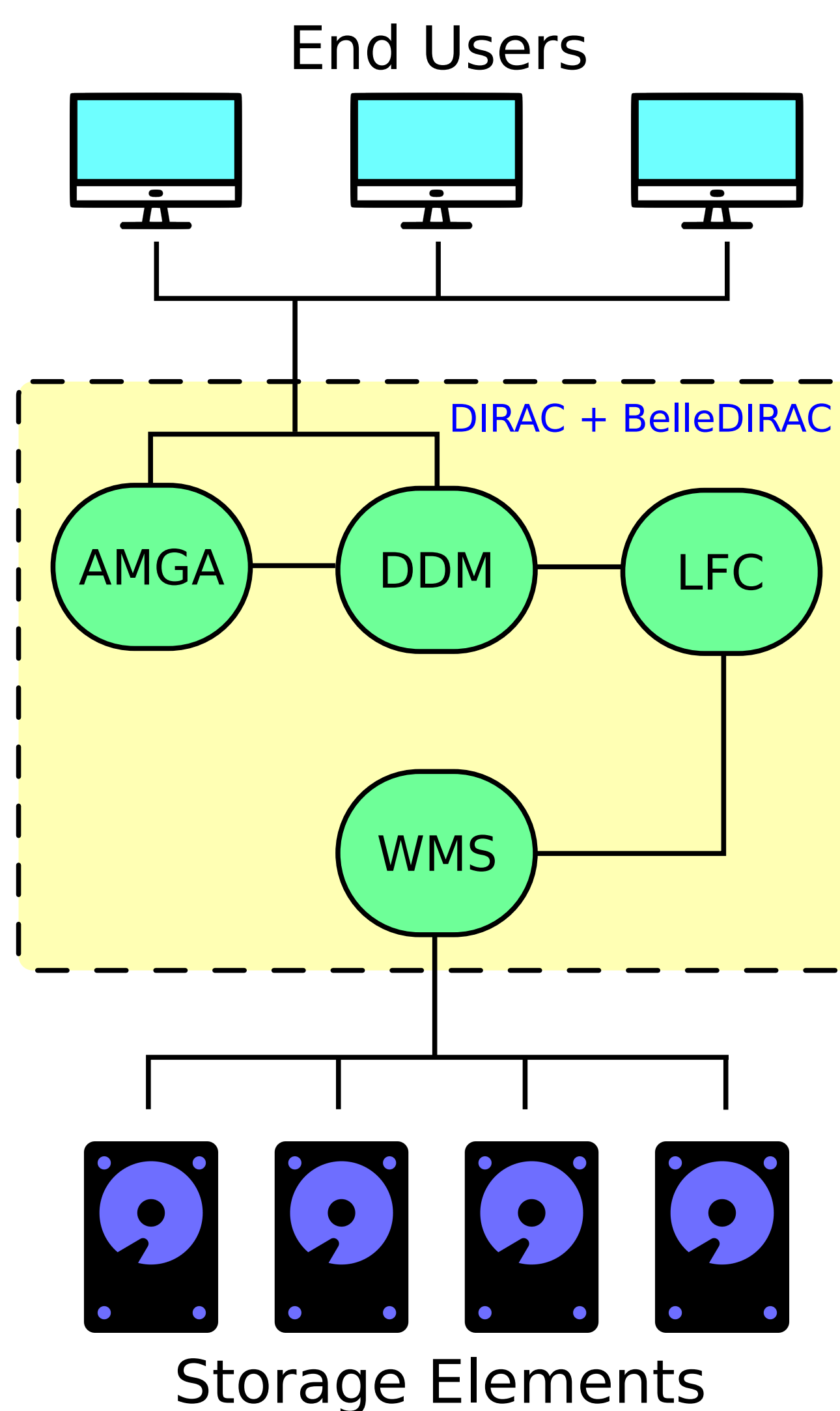
Requirements

In order to minimise the time spent locating data by the user, any potential solution would need to be able to perform the following tasks quickly and seamlessly:

• Browse the Belle II computing grid via a user friendly interface.

• Find all metadata associated with a specified LPN by the user.

• Find all LPNs matching a user provided set of metadata.

• The underlying database must support CRUD functionality, ie. for those with the correct permissions it should be easily modifiable.

• It must be able to perform all of these tasks in much less time than it would take to query the AMGA database directly.

Our Solution

We have created our own much smaller MySQL based database which will only contain datasets that are relevant to users. This would only need to query AMGA when new entries are added, resulting in much faster retrievals of metadata.
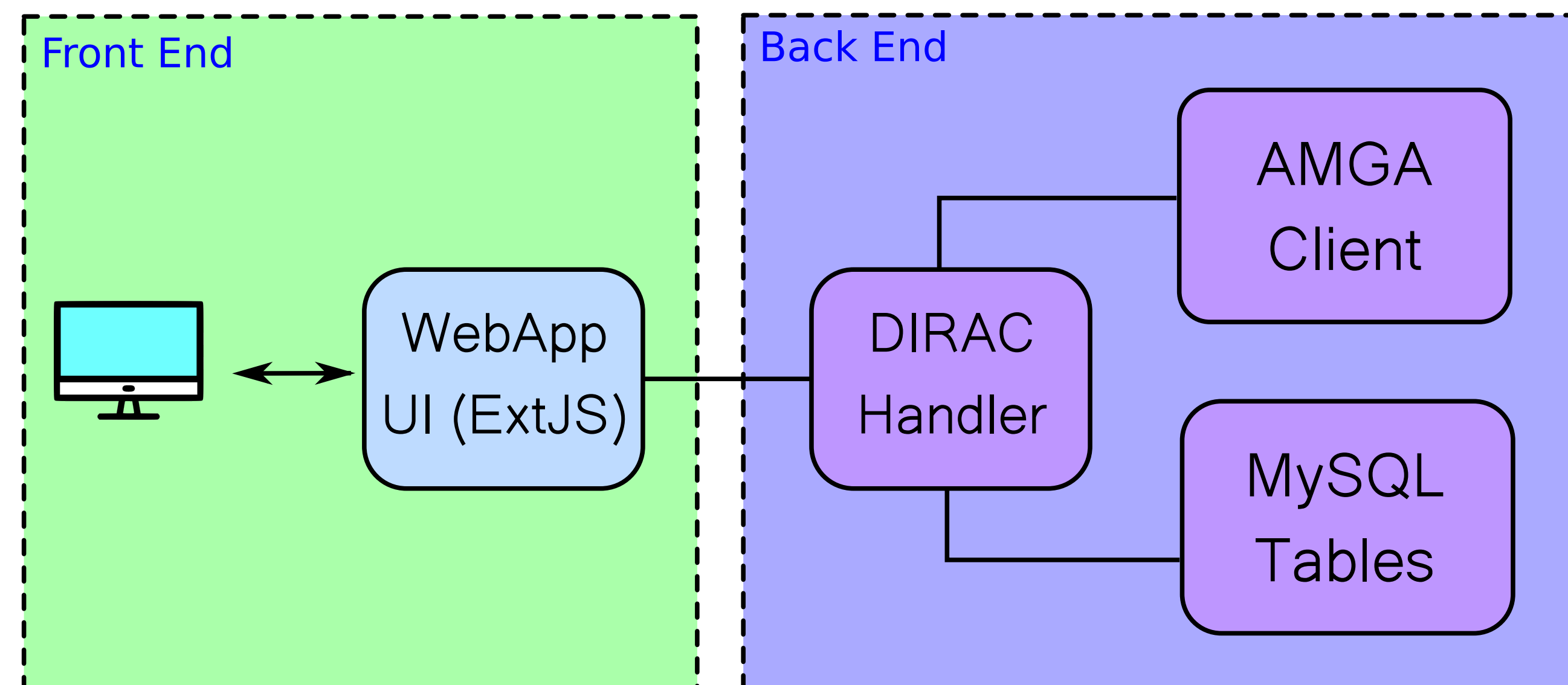

MySQL has an effective VARCHAR limit of 255 characters when creating a "primary key" in a table. Currently at Belle II our LPNs are close to this limit. This results in poor performance during lookups and insertions. Instead we store the LPN with no unique contraints and the SHA1 hash of the LPN as a unique key. Doing this improves the insertion performance and increases the LPN character limit to 1018, which future proofs us in the event that Belle II increases the LPN length.

Key Features

Includes a simple tree browser for manual exploration of the Belle II grid file system taken from AMGA

Supports MC and real data using a range of search criteria commonly used by Belle II analysts
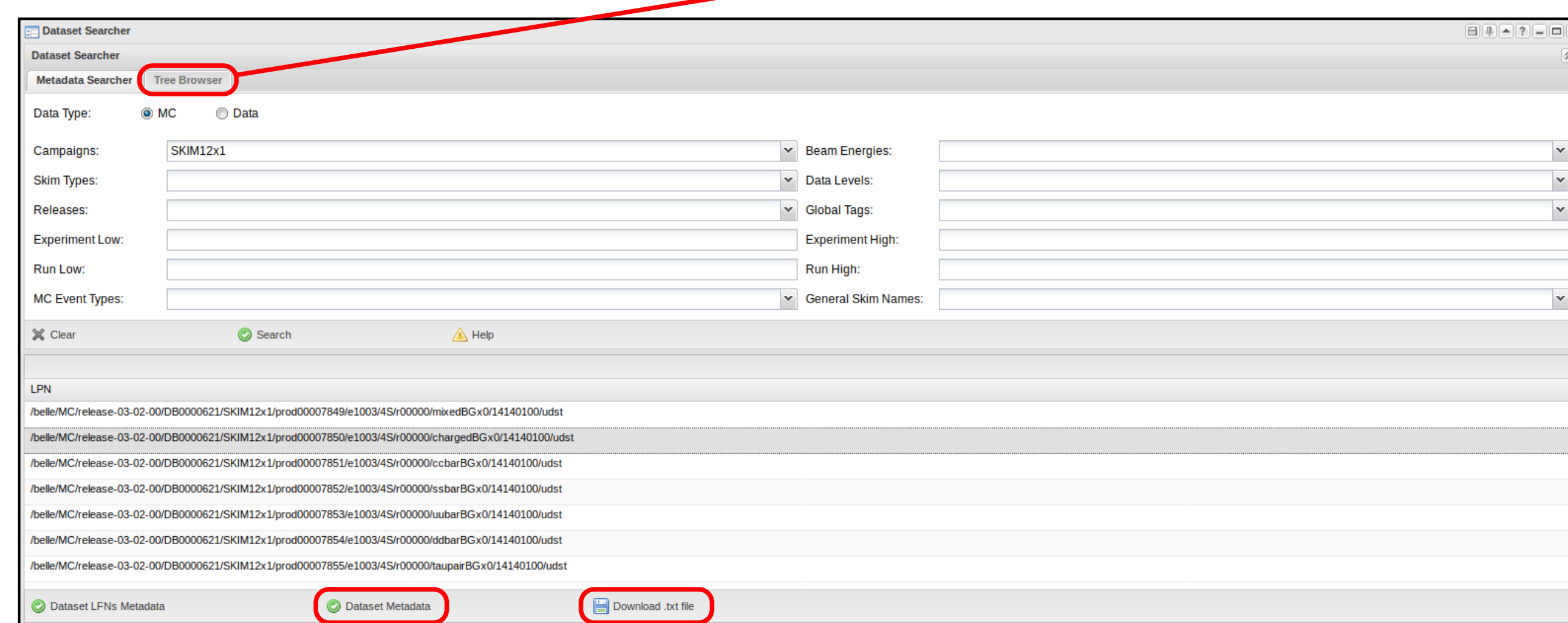
Can view all metadata for a given LPN or even all the LFNs contained within it by directly querying AMGA

Ability to save all search results into a text file for offline reference or for passing into other grid tools
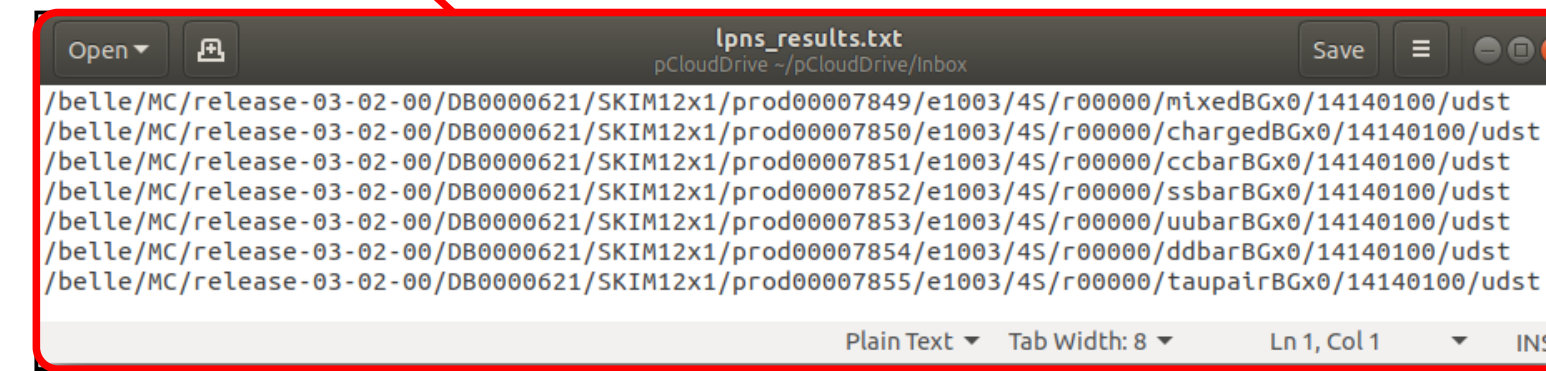
Future Plans

Short Term

• Fill the database with LPNs at the request of those in charge of data production and management.

• We have some in-development DIRAC python scripts for interfacing with the database via a command line. These will be become official grid based tools to provide an alternative way to use the database.

• Act on crucial feedback on what features need to be added or modified.
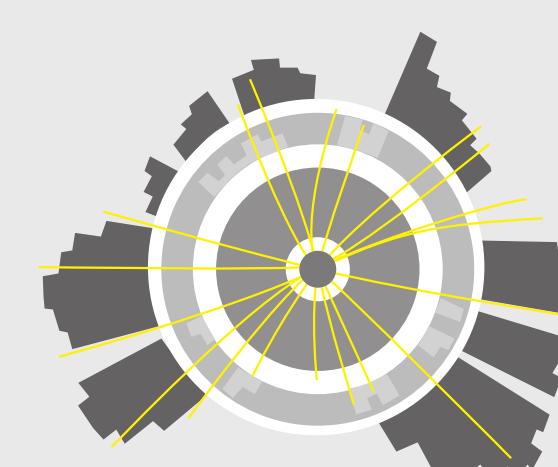
Long Term

• Create an agent for the automated addition of new LPNs requested by the data production team.

• There are plans for the current DDM system to be replaced by Rucio. During the later stages of deployment the LFC should also be retired in favor of Rucio.