sPhenix Conditions Database

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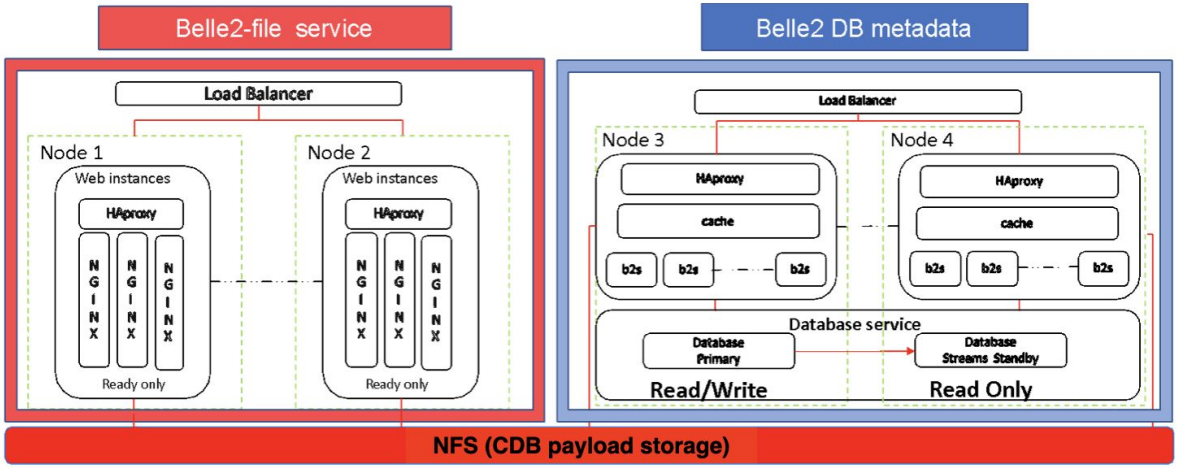
Introduction

- As a starting point we used the BelleII Conditions Database
  - NPPS software, SDCC operations
  - Working stably in production since 2018
  - Originally from PNNL, written in Java (I'm main developer now)

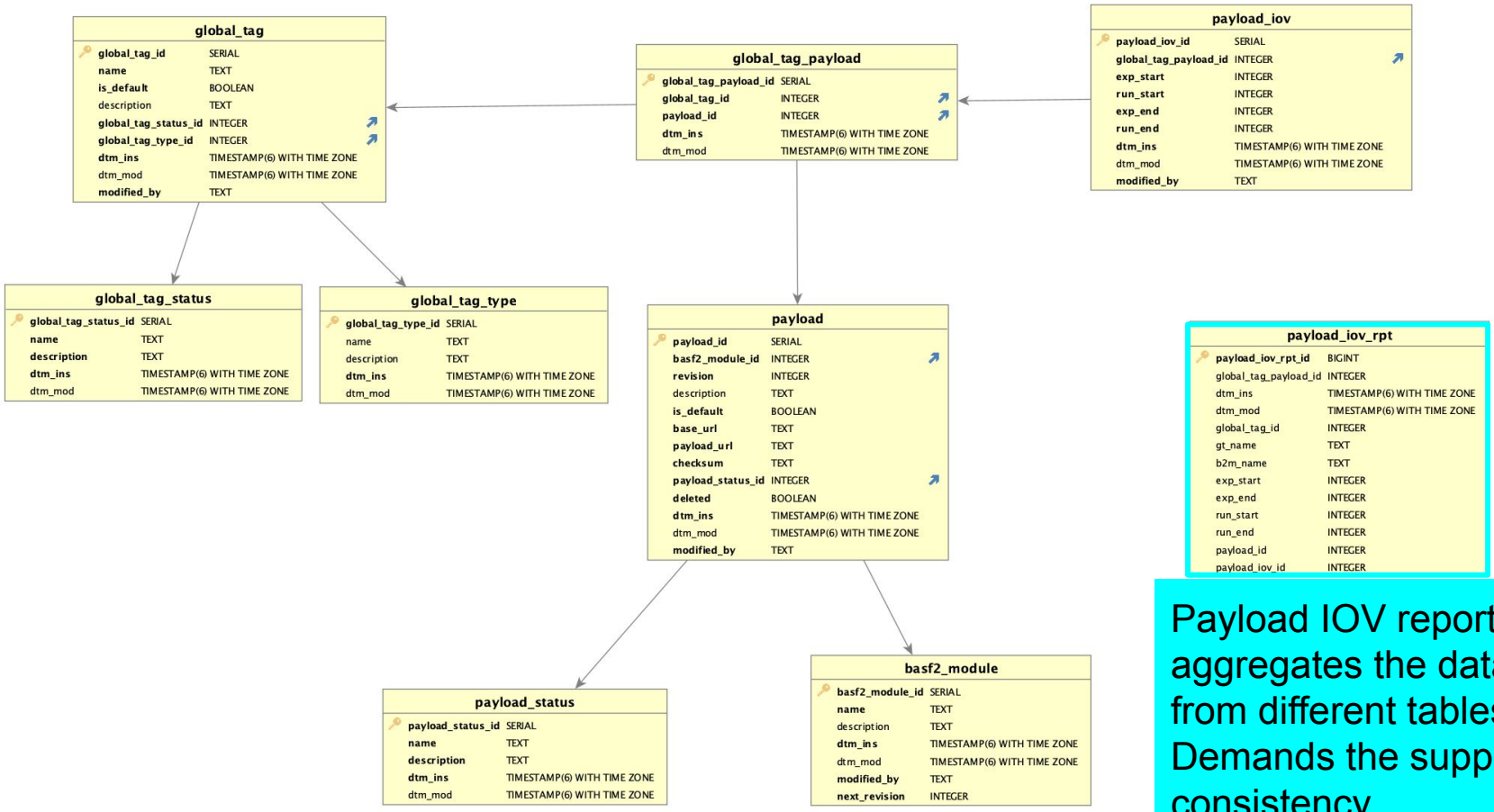
- Design concept: separate metadata from payloads
  - The metadata DB is separated from payloads so the CDB service effectively returns a list of URLs to retrieve the payloads

The Belle II Conditions DB



- A file service (left) serves the conditions data payloads
- The metadata service returns the list of payloads URLs. On the client side it is trivial to modify the path with a different prefix, so the preferred location of payloads is usually cvmfs

B2 Conditions Database schema



Payload IOV report table aggregates the data from different tables
Demands the support for consistency

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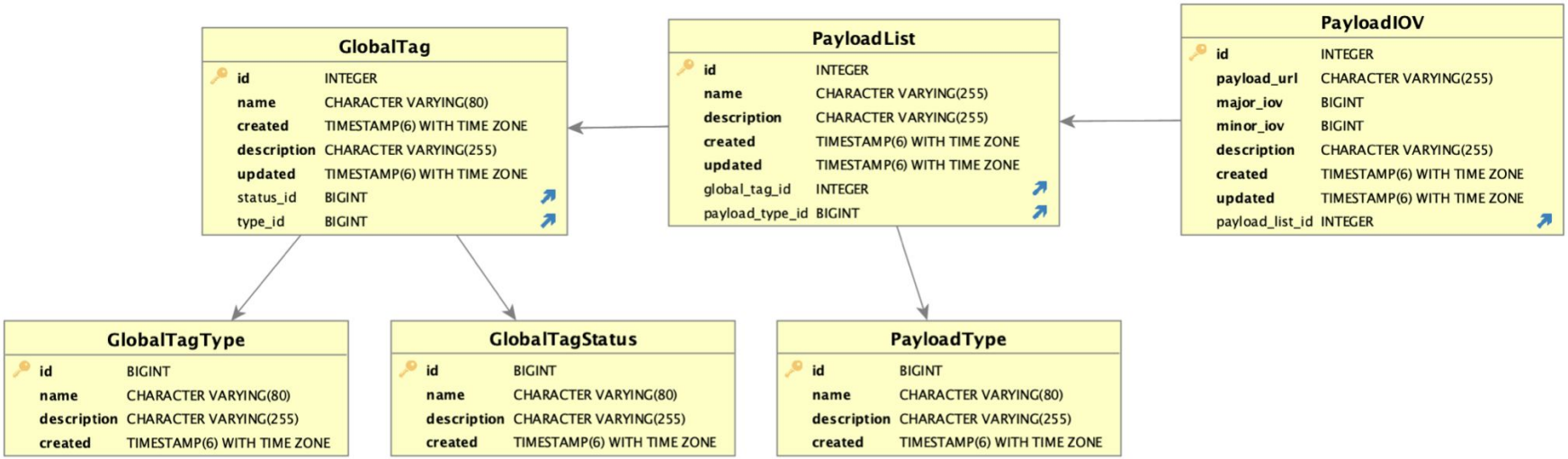
Streamlining the Server code and DB schema

- Use this as an opportunity to simplify both the code base and DB schema
- Change from Java to Django for simplicity and easier to support
- This is an opportunity for Belle II that we are happy to take

New CDB schema



- Implemented schema provides simple navigation from the Global Tag to the Payloads
  - GT has Type and Status (Locked || Unlocked)
  - Payloads are grouped by Payload Lists which collect all of the calibrations of the same type. List also has Type attribute
  - Payloads stored together with IOVs presented by two BIGINT fields: major and minor IOVs - start of the Payload validity.
    - One IOV ends where the next IOV starts

APIs

- Django implementation is based on rest_framework library
- Implemented APIs:
  - “Create” (POST) endpoints. Accept object as JSON
  - Query current Payloads for a given Global Tag and IOVs
    - Main call from software framework
  - Deep copy of the Global Tag

API calls

- API can be called with the standard (GET||POST) requests using cURL or program libraries
- An example of the cURL GET Request:

curl 'http://127.0.0.1:8000/api/cdb/payloadiovs/?gtName=TestMedGT5&majorIOV=0&minorIOV=1630825065'

[{"id":8977,"name":"TestMedPayloadList0","global_tag":{"id":116,"name":"TestMedGT5","description":"","created":"2021-09-02T07:33:57.612512","updated":"2021-09-02T07:33:57.612525","status":1,"type":1},"payload_type":{"id":1,"name":"Type1","description":"","created":"2021-08-04T13:54:47.835407"},"payload_iov":[{"id":6279079,"payload_url":"testPayloadMed4999_8977","major_iov":0,"minor_iov":1630576781,"payload_list":8977,"created":"2021-09-02T09:59:41.649975"}],"created":"2021-09-02T07:33:57.638153"},...

Get example

```
GET /api/cdb/payloadiovs/?gtName=ARICHdata&majorIOV=3&minorIOV=3
```

```
HTTP 200 OK
Allow: GET, HEAD, OPTIONS
Content-Type: application/json
Vary: Accept

[
    {
        "id": 8246,
        "name": "ARICHModuleTest",
        "global_tag": {
            "id": 106,
            "name": "ARICHdata",
            "description": "",
            "created": "2021-08-27T10:39:03.282104",
            "updated": "2021-08-27T10:39:03.282180",
            "status": 3,
            "type": 1
        },
        "payload_type": {
            "id": 1,
            "name": "Type1",
            "description": "",
            "created": "2021-08-04T13:54:47.835407"
        },
        "payload_iov": [
            {
                "id": 792659,
                "payload_url": "dbstore/ARICHModuleTest/dbstore_ARICHModuleTest_rev_3.root",
                "major_iov": 0,
                "minor_iov": 2,
                "payload_list": 8246,
                "created": "2021-08-27T10:39:04.370853"
            }
        ],
        "created": "2021-08-27T10:39:03.741195"
    },
```

- GT and its Payloads were migrated from the BelleII CDB
- The output is the list of Payload Lists with PayloadIOVs

Payload URL,
major and minor IOVs

POST Request

- POST Requests accept JSON body with Objects definition
- Global Tag creation example. GT's definition as JSON:

```
{"name": "TestGT1",
 "status": 1,
 "type": 1}
```

curl --header "Content-Type: application/json" --request POST --data '{"name": "TestGT1","status": 1, "type": 1}' http://127.0.0.1:8000/api/cdb/gt

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Python example

```python
#Create PIOV
base_url = 'http://127.0.0.1:8000'
url = base_url + '/api/cdb/piov'

for i in range(0,5000):
    iov = int(time.time())
    pname = 'testPayload_%d' % (i)
    piov = {
           'payload_url': pname,
           'payload_list': payloadListId,
           'major_iov':  0,
           'minor_iov': iov
           }

    r = requests.post(url = url, json=piov)
    data = r.json()
    payload_id = data['id']
```

```python
# Get PIOVs
base_url = 'http://127.0.0.1:8000'
url = base_url + \
      "/b2s/rest/v2/iovPayloads/?gtName=%s&majorIOV=%d&minorIOV=%d" \
      % (gtname,majIOV,minIOV)

r = requests.get(url=url)
data = r.json()
```

- Examples of population the Payload List by 5k PayloadIOVs and retrieving of the PayloadIOVs

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Scalability tests

- Moderate usage of IOVs would be calibrations updated every day (26 weeks of running time)
  - 1/day, 7/week, ~200/year of running
  - This is 20k payloads assuming 100 payload lists
- Heavy usage of IOVs would be calibrations updated every hour
  - 1/hour, 24/day, 168/week, ~5k/year of running
  - This is 500k payloads assuming 100 payload lists
- Worst case scenario is that calibrations are updated every 10 minutes,
  - 6/hour, 144/day, 1k/week, ~26k/year of running
  - Worst case use 200 payload lists to make it painful!
  - This is 5 million payloads!

Conclusions

- "Demonstrator" prototype is implemented
- Next step is to run number of scalability tests including test with multiple clients running in parallel
  - Prepare 3 testing Global Tags according to the moderate, heavy and worst case scenarios
    - All Payloads have unique names
    - Use minorIOV only
- Looking at code optimization