Global Information Management System for HEPS

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INTRODUCTION

High Energy Photon Source(HEPS) has constructed at suburban areas of Beijing in the end of June in this year. HEPS is a big complex science facility which consists of the accelerator, the beam lines and general facilities. The accelerator is made up of many subsystem and a large number of components such as magnets, power supply, high frequency and vacuum equipment, etc. Variety of components and equipment with cables are distributed installation with distance to each other. These components during the stage of the design and construction and commissioning will produce tens of thousands of data. The information collection and storage and management for so much data for a large scientific device is particularly important.

Database system will provide global database for lighting project and application services, including accelerator, beam line, HEPS project management, application software and database, thus ensuring HEPS whole big science device from construction, installation and put into operations generated by the uniqueness of huge amounts of data, in order to fully improve the availability and stability of the accelerator, and experiment stations, and further improve the overall performance.

This system designs the related database according to the comprehensive requirements of physics and management, and develops the Application Programming Interface (API) and some database Application software. After passing the test stage and initial operation, the database and application software will be deployed to the computer room of the computing and network communication system, and professional database managers will be responsible for daily operation management and performance optimization.

DATABASE DESIGN

The whole HEPS database covers a large range, and it is difficult to complete the design and construction in one time with limited human resources. Therefore, the database can be functionally broken up and modularized into several smaller databases to be developed separately and done in collaboration with other labs. Each module is connected by simple modification of Primary key and Foreign key, data acquisition API or software service.

The overall architecture of the accelerator and beam line (non-experimental data) database set was based on IRMIS(Integrated Relational Model of Installed System) v3, and was designed based on the collaborative work of the former DISCS[3] international accelerator database. This part of the database will be open source database such as MySQL. Most of the databases related to project management are based on MS SharePoint, so most of them are stored in MS SQL database built in SharePoint in the form of document whole and content decomposition data.

For the Mysql-based accelerator and beam line database, MySQL Workbench or other visual schema editing tools as shown in the figure 1 are used to design the database schema according to user requirements. After the schema preliminary design is

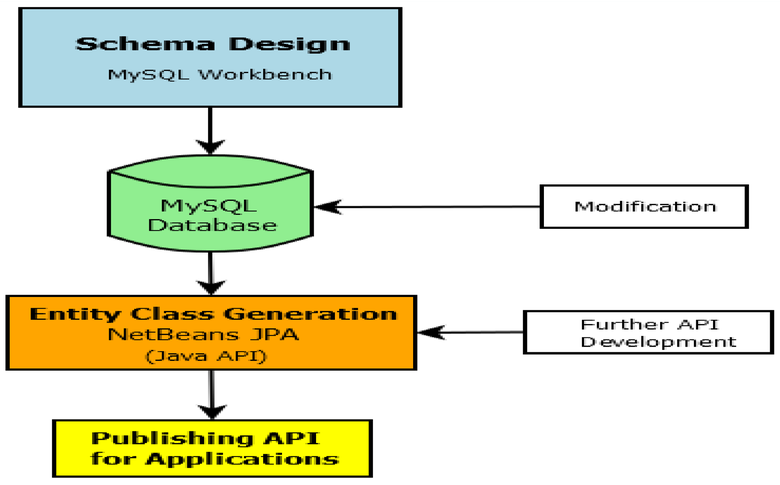


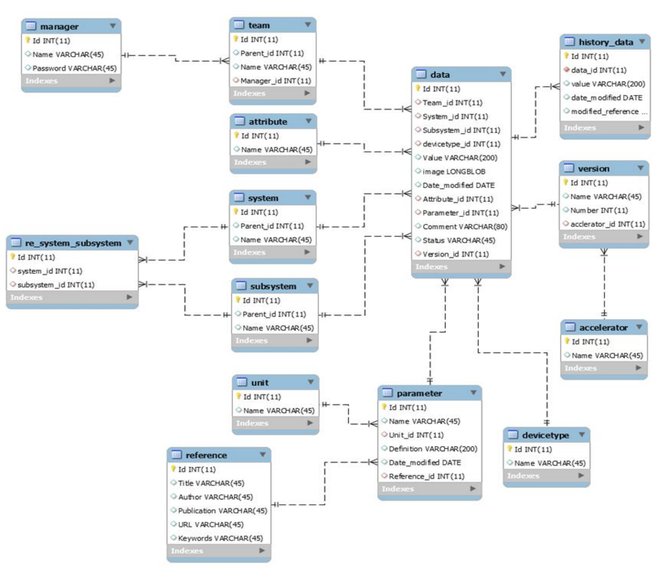
Fig. 1:Typical Relational Database Development

Critical database

The overall HEPS database covers a large range. At present, we have planned 17 working modules based on relational database according to functions, which are detailed as follows:

- Parameter List
- Naming Convention
- Magnet
- Lattice/Model
- Device/Configuration
- Physics/Save/Restore
- Logbook/Issue Tracking
- Operation/Maintenance
- Inventory
- Survey/Alignment
- Work Flow Control/Traveler
- Tech Notes/Documentation
- Cable
- Authentication and authorization
- Machine Protection System/ Interlock
- Alarm
- MPS Postmortem Analysis

Parameter Table database



Parameter Table DatabaseWeb Application

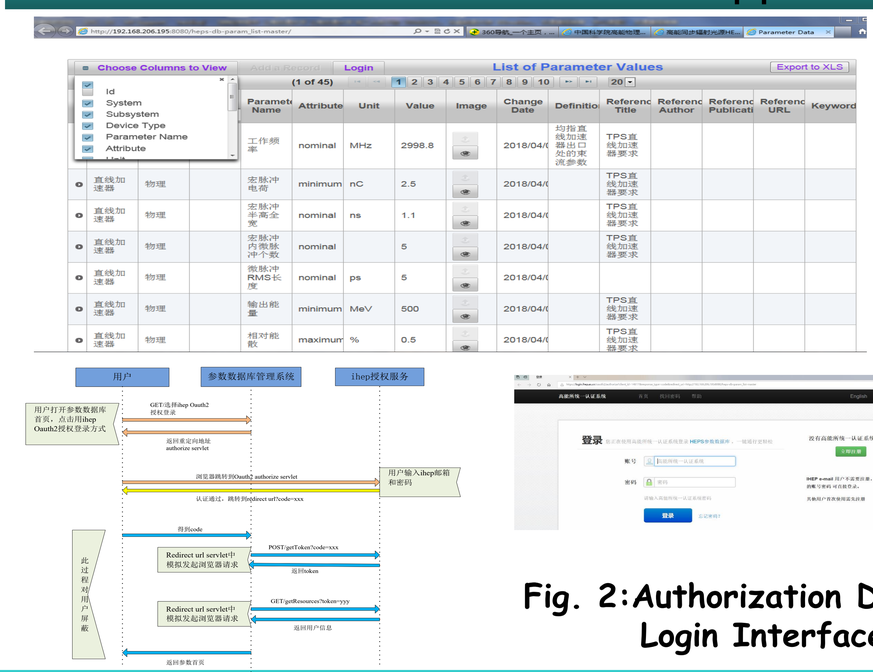


Fig. 2:Authorization Database Login Interface

INTELLIGENT DEVICE MANAGEMENT SYSTEM

This system provide the following functions:

- Equipment from "life" (start to use) to "death" (scrap) full information management including equipment file management, equipment distribution management, equipment allocation management, equipment scrap management, equipment classification management and equipment manufacturer management.
- Automatic generation of equipment inspection, automatic distribution of tasks, linkage maintenance business.
- Mobile terminal equipment repair, receive maintenance application, maintenance registration, acceptance and maintenance work. Inquire maintenance record, statistic equipment failure rate, generate maintenance account.
- Automatic generation of equipment maintenance, automatic distribution of tasks, linkage maintenance business.
- Conduct periodic inventory of equipment assets using equipment ledger and RFID tags.
- Fast and efficient, automatic production of inventory records and ledger.
- Make spare parts plan and budget.
- Generate all kinds of required business statistical reports, standard desk accounts.
- Export EXCEL/PDF format, query authority can be assigned and controlled.
- Through big data analysis of various state data of the equipment, we can provide the problems that may occur in the equipment, and take the initiative to repair and maintain the equipment in advance, so as to avoid modification after failure.
- Equipment maintenance "foresight, nip in the bud", keep the equipment in good condition for a long time, reduce the failure rate.

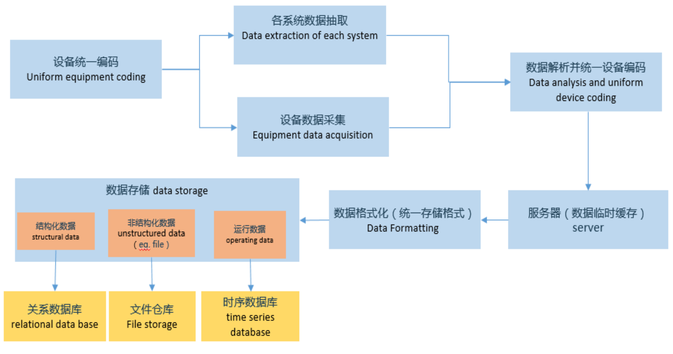


Fig.3: Data Access Scheme

Objective is to solve the information management of the HEPS equipment from construction, installation and operation, so as to reduce the tedious manual labor. We will set up a complete relational database from the naming rules of the device. On this basis, all kinds of customized tables are automatically exported out. People can use mobile phone to scan QR code to track the whole process of the equipment (budget,purchase,warehousing, receiving and other information), and quickly browse.