

INFORMATION TECHNOLOGY TO MEET NEW ASSESSMENT REQUIREMENTS IN THE SOUTH PACIFIC

Since 1989, SPBEA has been providing a single level Year 12 (Form 6) qualification to schools in its member countries of the South Pacific. In 2004, SPBEA will offer a Year 13 qualification for the first time. The expansion into multi-level qualifications brings new assessment demands, which in turn make demands on the Board's Information Technology and Systems resources. Specific requirements that need to be met are-

- The provision of systems to handle learning records so qualifications can be accumulated over a period of more than a year;
- The introduction of permanent student identification numbers;
- The establishment of a permanent record of learning database (ROL) and its integration with the current examination databases and associated client interface software;
- The introduction of electronic methods of capturing assessment grades and marks over an extensive geographical area using email;
- The need for software tools designed specifically for assessment research so as to provide data on the quality of assessment;
- The need to examine the use of enterprise strength database technology such as SQL Server, to better meet security demands and provide an appropriate platform should the Board wish to move to web-based delivery of services in the future.

1. Multi-Level Learning, and Gaining Qualifications over an Extended Time Period.

Since its inception in 1989, SPBEA's **Pacific Senior Secondary Certificate (PSSC)** has shown that significant numbers of candidates return to school to repeat the course once, twice and in rare cases, three times. For instance in 1997, 381 candidates out of 2187, were 1st year repeaters, while 8 repeated the course for a third time. These figures remain typical (proportionally) through to 2003 when candidate enrolment rose above 3000. This means a significant number of students have accumulated a list of subject results, sometimes improving on past efforts and sometimes adding new subjects. These results, however, have only been reported on a year-by-year certificate. SPBEA has never issued a cumulative record of learning over the period the student studied the course. There has never been a demand for it, nor has SPBEA attempted providing the service.

The introduction of the **South Pacific Form Seven Certificate (SPF7C)** in 2004 opens new possibilities for schools to offer multi-level courses to students so they can both continue with PSSC studies in some subjects, while having a chance to commence studies at the higher Form 7 level. The SPF7C is awarded when a minimum of 3 subjects have been achieved at a grade of B or better and students will be able to do this over a period of one year or more. History shows that significant numbers will be in the category of students who take two or more years to achieve the qualification. SPBEA needs to respond to this by

offering multi-level reporting, and to do this it will have to establish a new single database dedicated to retaining student achievements for all years they study both qualifications offered by the Board. This will be a **Record of Learning** and known as the **ROL database**.

The concept of a single Record of Learning database brings a new set of requirements and the most important of these will be a need for candidates enrolling in any SPBEA approved subjects to be issued with a personal student identification number. Perhaps this will eventually be referred to as a **SPIN (South Pacific Identification Number)**, and this term will be used for the purpose of this paper.

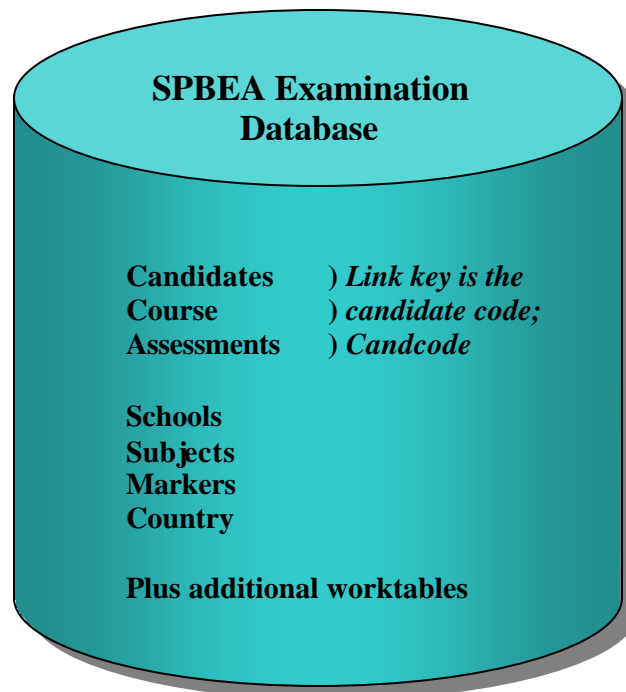
SPIN's bring a new set of business requirements.

- How are they issued? Do the students apply for them? Or do the schools apply on their behalf?
- How are they maintained? And by whom?
- How is uniqueness maintained? What happens when a student changes school? Country? Can this lead to duplicates?

Whatever the final answers are to these questions, it is logical that SPBEA controls the issuing of SPINs. Clearly SPBEA will need to have systems that can detect duplicates when the situation arises.

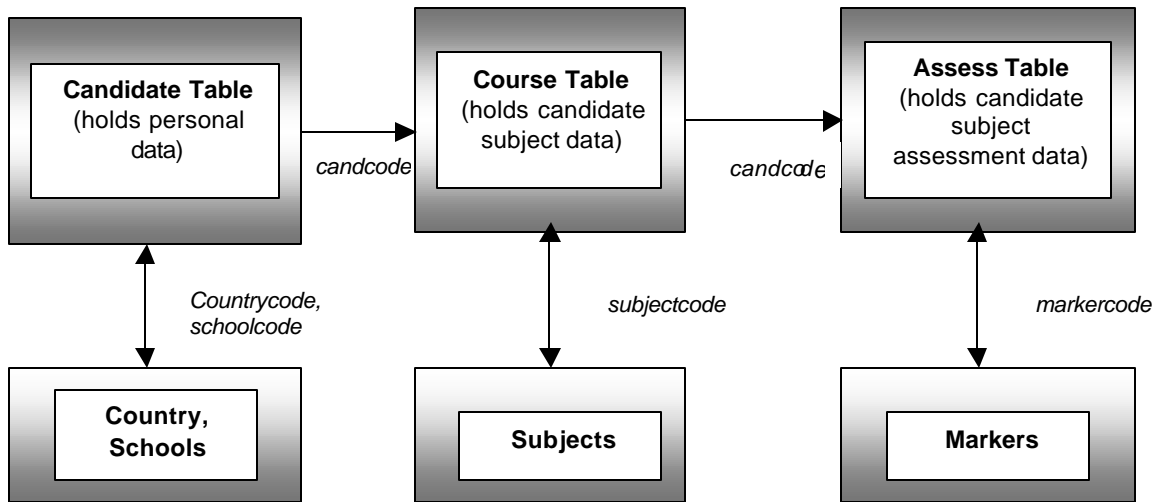
2. A Database Model to meet the New Requirements

The current model uses MS Access 97 technology. It is referred to as the ATLAS database, ATLAS being the name of the interface software developed by the Board to manage the PSSC qualification.



The heart of the database is a group of three tables related through a common key called the candidate code (*candcode*)

The entities inter-relate as follows



A fresh database is generated each year by making a copy of the previous year's database, and then deleting the candidates and their related data. This has worked well for the board over the last 14 years, but with the introduction of SPF7C, it is no longer adequate.

A New Model for Multi-level Qualifications

The above model re-creates tables which largely contain data that is permanent and changes little from year to year. Country, Schools and Subjects are supporting tables, containing data essential to the business of administering qualifications.

School and Country tables should be separated into a database of their own and placed in a **Providers database**.

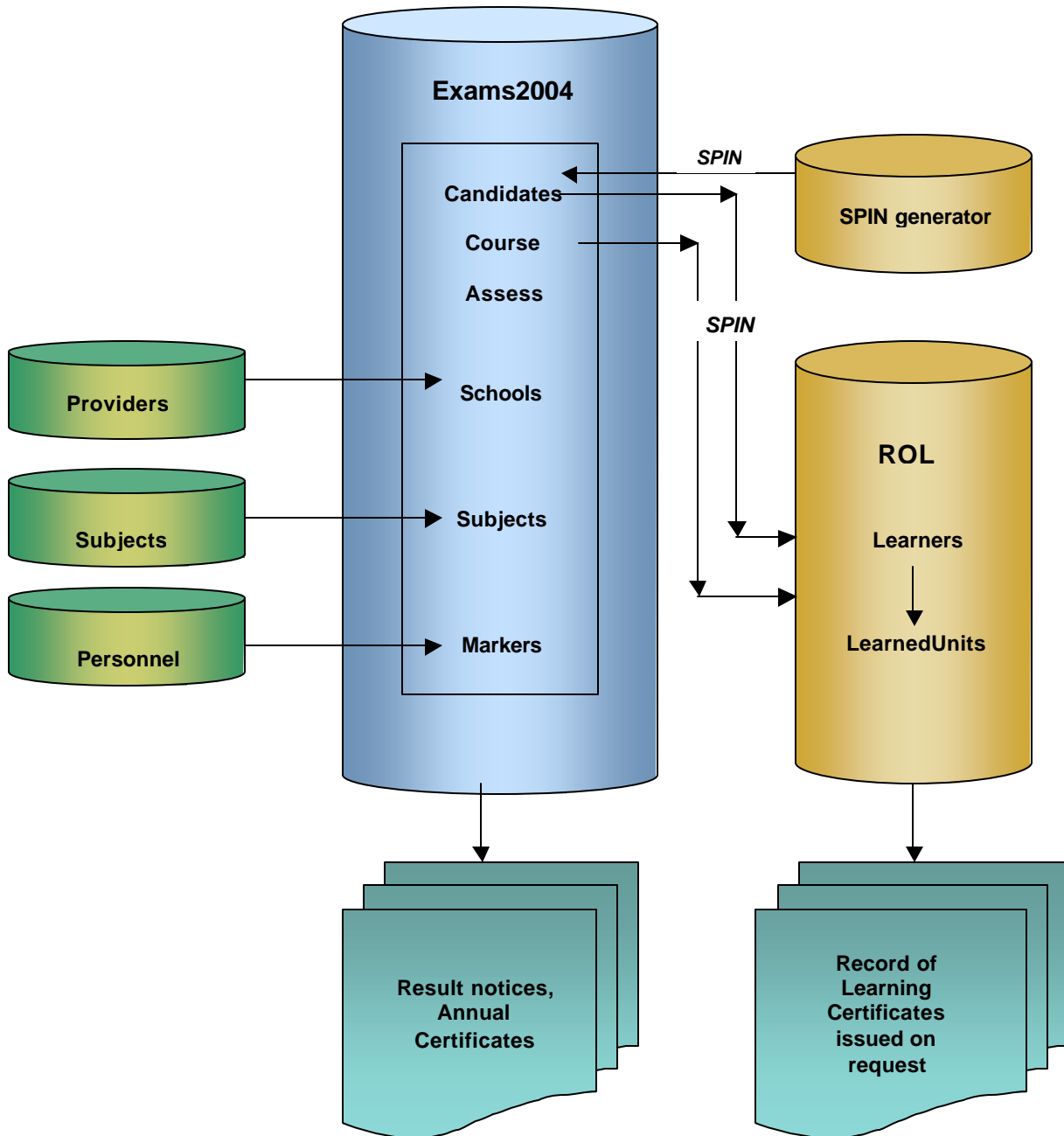
Subjects should be maintained in a **Subjects database**.

Markers are people contracted by the Board, and are better placed in a **Personnel database**, which can also hold information about all people contracted by the Board.

A **Record of Learning database** is needed and will be referred to as the **ROL**. Associated with the ROL will be a small database that maintains the SPIN numbers allocated to students.

The tables, Candidates, Course and Assess will remain in an **Examinations database**.

These entities can be shown as follows. They will make up the **ATLAS Database System**.



Initially MS Access 2000 will be used as the underlying database, but MS SQL Server may well be introduced in the future to provide much needed data security.

3. Collecting Data across the South Pacific. The Einstein System

Nearly all subjects offered by the Board have a significant internal assessment component, together with an external examination. Couple this with the fact the Board examines over a very large geographical area that encompasses three time zones, and it can be seen the new SPF7C will add to growing data collection problems.

In 2004 SPBEA will implement a modified version of the Einstein technology developed at NZQA in New Zealand and used for a five-year period to capture candidate marks from Markers. In 2003 it was replaced by a very successful web-based system.

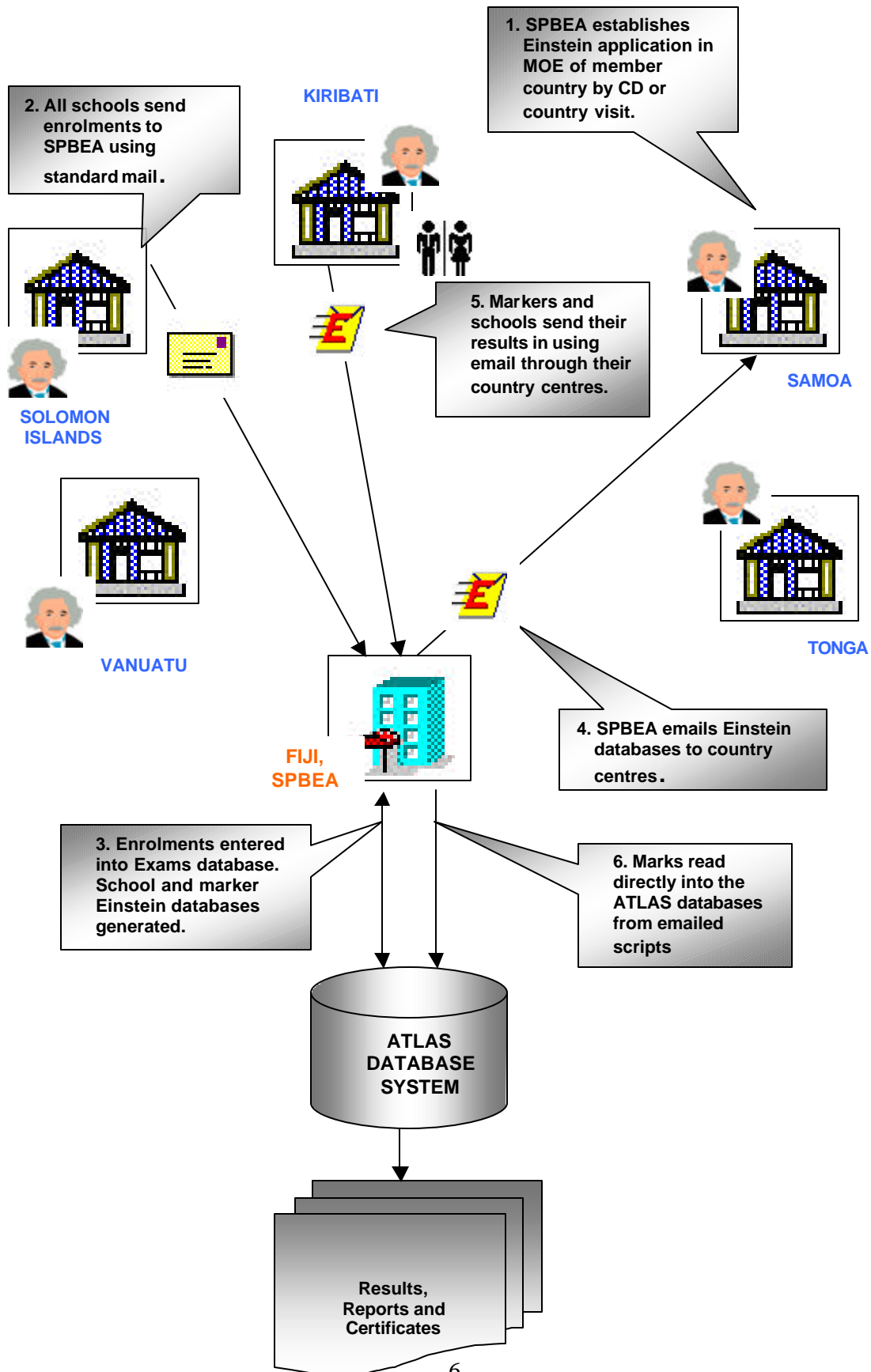
The central feature of the system is a small computer programme called Einstein. Markers use it to enter marks into a table and must do so twice for validation purposes. So it is electronic mark capture– twice (emc2)!

All markers were sent a CD with the application and set it up on their own computer. Later, when candidates had been allocated to them for marking, a small Access data file of their candidates was sent to them by email. They then filled in their candidate marks and repeated the exercise to verify the accuracy of their data. When this had been completed, Einstein generated a small text file of the data, and the Marker sent this back to the examining authority by email attachment for direct entry into the examination database.

The following modifications will need to be made for the system to work in the South Pacific.

- Computing and Internet costs are still too high in the region to expect all markers and schools to have a computer with Internet access. SPBEA will therefore establish Einstein computer centres in each country to manage the transfer of marks from their schools and any marker panels to SPBEA.
- Once enrolment has been completed, SPBEA will send Einstein Access tables designed to capture Internal Assessment data from all schools in the country, as well as marker tables to capture marks from any marking panels established in the country.
- Centres will email internal assessment data as it comes to hand, and external marks at the end of the year.
- All data entered by SPBEA into the Examination database will be automatic and will not require verifying. Missing mark checks will be required.
- The key element of the Einstein system is that it moves the requirements for data preparation and validation from the examining authority to the markers.

EINSTEIN SCHEMATIC

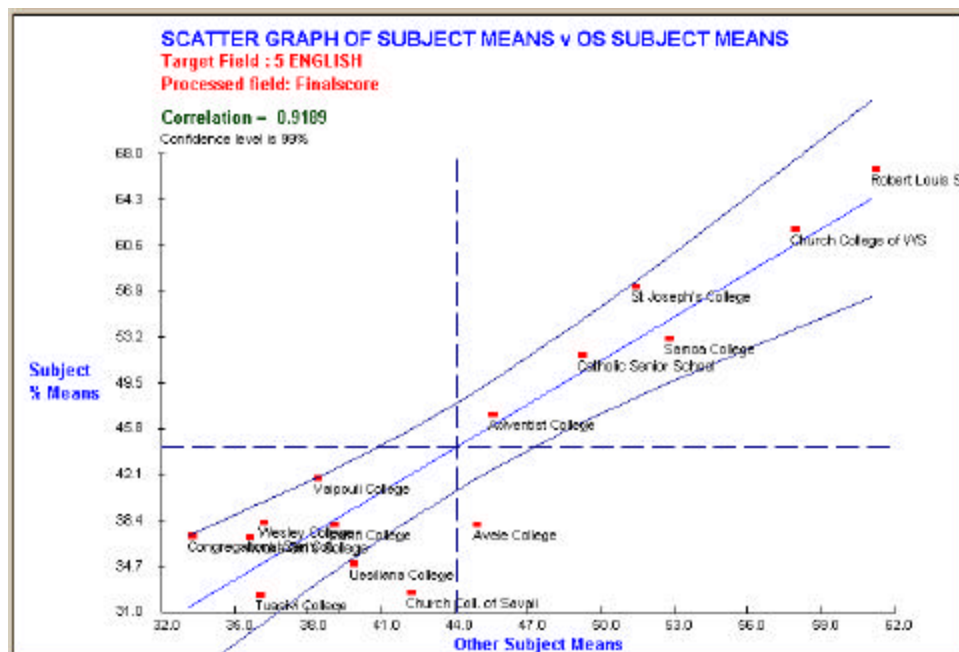


4. Monitoring the Quality of Assessment

South Pacific countries, keen to develop their own secondary education systems, need good tools to determine whether their standards are improving or not. SPBEA stands as a proxy qualification authority acting on behalf of its members. The Board is well placed to promote international recognition of the qualifications it runs on behalf of its members, and indeed, the introduction of SPF7C makes it imperative it continues to closely monitor assessment standards and constantly provide feedback to member countries and schools with regard to standards.

SPBEA has two computer applications designed to gather data, analyse it, and present reports in ways that the information can provide feedback for teachers, school administration, Ministries, and assessment professionals.

- **TITAN** (Test Item Analysis). As the acronym says, this is a test item analysis program that samples a batch of candidates' responses and produces reports and graphs based on classical item statistics. The application has a long history at SPBEA with the first version being developed in 1989. Recently it has been up-dated to a Windows version making greater use of graphics to display its results. Specifically, TITAN reports are used by Examiners to determine the quality of items and the quality of student knowledge.
- **SPARTA** (SPBEA's Analytic Research Tool for Assessment). This application is a mixture of an SQL generator together with a set of special functions to analyse and report on special aspects of assessment. As an SQL generator, the application can be used with any Access database. One of its special features is the ability to analyse the performance of a specific group in relation to others involved in the same measure. The figure below indicates how Western Samoan schools taking English performed in relation to each other as measured by the means achieved by each group in their other subjects.



The analysis is done by determining the average mark awarded English students in each school, compared to the average mark the same group scored in all their other subjects. The example shows that there is a good correlation between the two scores and the 95% confidence lines are plotted which tell us that within these lines, the variation shown is due to natural random behaviour. Those schools outside these lines can be assumed to be performing better or worse than expected.

This kind of information is useful to panel leaders the following year if the same panel is used again.

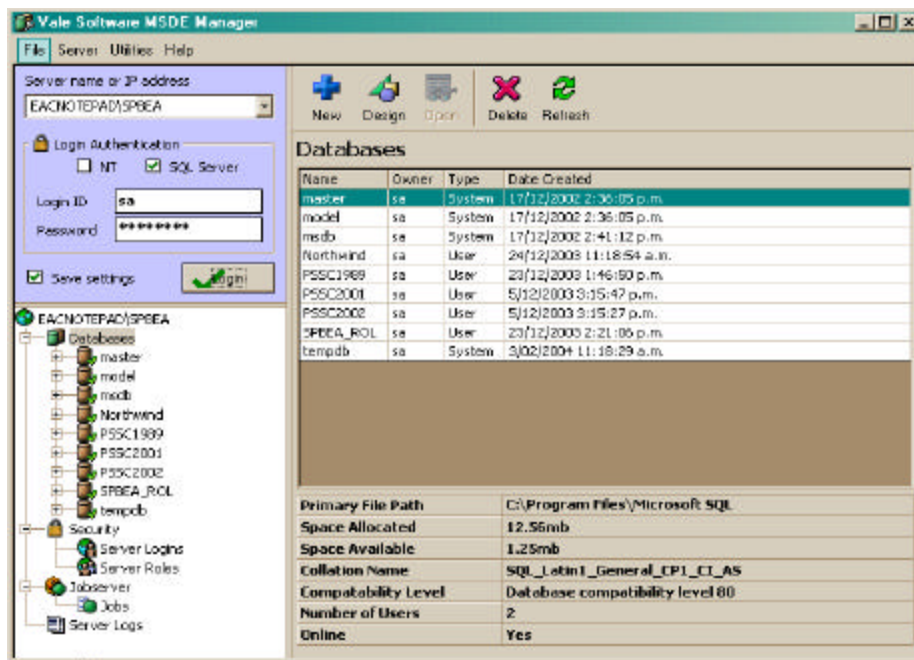
5. Security, Modern Databases and Future Directions

While developments for 2004 will follow the well-worn path of using MS Access database technologies, 2005 may well be devoted to migrating all databases to MS SQL Server technology.

To follow this route fully is expensive for a small organization like SPBEA working with limited finances. However there are means around this.

Microsoft make their SQL 2000 server available in a light mode called MSDE 2000 (Microsoft Database Engine). It is a fully functional database server with all the standard features of their enterprise strength server, but it comes with no client software. It is distributed as part of Access 2000 and can be found on the Internet as a freeware download. The server will function on any PC with Windows 2000 or higher.

Vale Software (<http://www.valesoftware.com>) retail an MSDE Manager for \$US79, and together with MSDE 2000, one has a very workable database server system which gives database managers great control over their systems. The figure below shows the database scheme visible through the manager.



Other 3rd party DBA tools for MSDE available from the Internet are-

- **SQL Buddy.** This is a freeware manager and available from <http://sqlbuddy.sourceforge.net>. Its security features are not as good as that available from ValeSoft.
- **MSDE Query.** This freeware application is an excellent query tool for those adept with SQL. It is available from <http://www.msde.biz/>. For \$US22 you can acquire a full management application similar to the above.
- **Data Transfer Services (DTS).** This is an important component of a full enterprise version SQL Server. It is distributed by Microsoft as part of Access 97 along with MSDE 97. By installing MSDE97 you get this extremely powerful application for transfer data between databases.

Database servers will eventually be the essential way forward for two major reasons.

- **Security.** SPBEA is entering the area of high-stakes learning because the SPF7C represents the end of secondary learning for students in the South Pacific. It will be their calling card to overseas universities and technical institutions. Cheating is a problem in the region, so security of the Examination and ROL databases will be a major consideration. Modern server databases come with a number of tools to ensure the data is as secure as possible.
- **Web-based Client systems.** The future lies with the web. The NZQA is in the middle of extensive intranet-internet developments to improve the immediacy of its systems for authority-client interaction. Already it has moved so that
 - Markers deliver their grades to NZQA via a special web page.
 - Schools submit compassionate requests via the web.
 - Results are available to candidates via the web.
 - Plus a very extensive range of performance statistics.

The day will come when SPBEA may well consider providing similar services, which means it will need appropriate database and web technology. By moving to database server technology in the immediate future, SPBEA will position itself with a suitable platform to move forward with confidence.

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