7.1. Conclusion & Future Scope

For creating container database and pluggable databases in multi tenant environment we have you used two approaches namely by using Oracle Universal Installer (OUI) which are wizards which can helps to create the required databases in menu driven form. In second approach we have used SQL commands to create the CDBs and PDBs which are little complex compare to the first approach.

In second approach we have created directories for storing audit file and for diagnostic destination. I have created parameter file in Perl script and then by using SQL Plus commands the CDBs and PDBs are created.

For accessing multi tenant databases we have created two database users i) common user in root CDB he can be connected to plug into all the pluggable databases. ii) a local user is created in the PDB where he can only access that PDB privileges only.

A pluggable database can be created in one of the three ways. i) creating pluggable database from the Seed ii) cloning an existing pluggable database iii) unplugging and plugging a database from a one CDB to another CDB. I have used all of the three techniques in this thesis.

To make more secure multi tenant database we have applied both and Data Redaction transparent data encryption techniques.

Redaction technique is applied to the tables for masking the sensitive data, here I have used 3 types of masking i) full redaction ii) partial redaction and iii) regular expression.
These actions can be applied either by means of Oracle Enterprise Manager Wizard and by writing SQL/PL SQL procedures. Both I have shown in the Thesis.

Finally I applied Transparent Data Redaction for encrypting the keystore and Master Keys.

Oracle Advanced Security provides such protection without causing performance or functional issues with database schemas. Oracle Advanced Security was easy to configure and implement, and its encryption and redaction functions operated efficiently and securely. Encryption key management was easy to set up, and keys can be stored in a secure wallet or hardware module. Redaction functions were easy to configure and automatically deploy by setting a few parameters.

Oracle makes a declarative policy-based approach to encryption and redaction simple to create, manage and change, thanks to Oracle Advanced Security’s data redaction and transparent data encryption features. In addition, applying the encryption and redaction functions to the data, as well as verifying that these functions were operating properly, was straightforward and easy to document, which is important from any compliance or regulatory perspective.

This proposed database system provides two critical preventive controls:

- Transparent Data Encryption encrypts data at rest to stop database bypass attacks from accessing sensitive information in storage.
- Data Redaction reduces exposure of sensitive information in applications by Redacting database query results on-the-fly, according to defined policies.
- Together these two controls form the foundation of a multi-layered, defense-in-depth approach.
This proposed Database will be the most advanced database security solution

The architecture can be modified according to the Saas Application getting implemented. The dashboard can be developed, which will help tenants to choose the configurable components for his applications in multitenant application. This will make the multitenant application highly configurable.

A multi-tenant architecture brings along with it its own set of challenges and one needs to think though these issues before deciding if multi-tenancy is the best way to go. When to implement a true multi-tenant architecture depends on various factors. The thing to keep in mind is that multi-tenancy is not the only way to go about architecting a SaaS solution. There are other alternatives to this approach, one of them being virtualization in conjunction with some level of multi-tenancy. Whereas a strict multi-tenant solution might be suitable for SMBs, larger enterprises with more acute needs and desires might not be too happy with a strict multi-tenant solution. This is where using a virtualization product from VMware to provide for virtualized storage and hardware might be a good compromise.