**Report on Access Control and Authentication**

**Scope of Access Control and Authentication :**

1. INTRODUCTION

DatabaseTsystemsTareToneTofTtheTcoreTcomponentsTinTanyTorganization.TAsTtheTsizeTofTtheTorganizationTgrowsTtheTcomplexityTandTdataTinTtheTdatabasesTalsoTgrowsTrapidly.TBesidesTotherTdatabaseTsecurityTfeatures,TtheTaccessTcontrolTmechanismTshouldTbeTflexibleTenoughTtoTimplementTdifferentTtypesTofTaccessTcontrolTpoliciesTperiodically.TFurthermore,TitTisTalsoTimportantTtoTmaintainTtheTconsistencyTinTtheTaccessTcontrolTmechanismTofTtheTdatabaseTsystem.

AsTweTtalkTaboutTtheTDatabaseTaccessTcontrolTmechanisms,TtheTdatabaseTgenerallyTfacesTmanyTthreatsTi.e.TinternalTandTexternalTthreats.TInTdatabaseTsystems,TtheTaccessTcontrolTmechanismTenablesTcontrolledTaccessTtoTsubjectsTonTobjects.TTheTmainTobjectiveTofTtheTaccessTcontrolTmechanismTensuresTconfidentialityTofTdata.TTheTrightsTofTtheTsubjectsTareTdefinedTandTcheckedTagainstTtheTsetTofTauthorizationTbyTtheTaccessTcontrolTmechanisms.TAnTauthorizationTstatesTwhetherTaTsubjectTcanTperformTaTparticularTactionTonTanTobject.TAuthorizationsTareTstatedTaccordingTtoTtheTaccessTcontrolTpoliciesTofTtheTorganization.TUntilTnowTtheTresearchTcommunityThasTdescribedTmanyTaccessTmodelsTforTrelationalTdatabaseTsystem.TSomeTofTtheseTare

* DiscretionaryTaccessTcontrolT(DAC)T
* MandatoryTaccessTcontrolT(MAC)T
* Role-basedTaccessTcontrolTmodelT(RBAC)T
* TemporalTrole-basedTaccessTcontrolT(TRBAC)T
* ReflectiveTdatabaseTaccessTcontrolT(RDBAC)

ThisTdocumentationTmanlyTtalkTaboutTtheTlastTtwoTmentionedTaccessTcontrolTmethods.

**CONTRIBUTIONTFROMTTHETPAPERSTTOTTHISTREPORTT**

TTheTAuthorizationTpartTofTtheTdocumentTisTcitedTformTpaperT[TAccessTControlTinTGeographicTDatabase]TpublishedTbyT{TLilianaTKasumiTSasaokaTandTClaudiaTBauzerTMedeirosT}TPageT[2,3]T.

TTheTReportTmainlyTfocusesTonTtheTnewTAccessTControlTMethodsTderivedTformTtheToldTmodels.TheTAccessTControlTmethodsTdiscussedThereTareT(1)OrganizationTBasedTAccessTControlT(OrBAC),T(2)TTemporalTRoleTBasedTAccessTControlT(TRBAC)TandT(3)TReflectiveTDatabaseTAccessTControlT(RDBAC)T.

TTheTrespectiveTcontentTisTcitedTformTtheTrespectiveTpapersT:

T1T.TFromTAccessTControlTModelsTtoTAccessTControlTMetamodels:TATsurveyTpublishedTbyT[MehdiTAdda, 5].

T2T.TTRDBAC:TTemporalTReflectiveTDatabaseTAccessTControlTpublishedTbyT[ZahidTRashid,TAbdulTBasitTandTZahidTAnwar ,338,T339,T340,T341,T342].

**Research Papers**

* + Paper 1 : [TRDBAC: Temporal Reflective Database Access Control, 2010, International Journal of Scientific and Research Publications]
  + Paper 2 : [Access Control in Geographic Databases,2011, IEEE/ACM Transactions on Networking ]
  + Paper 3 : [Database Security & Access Control Models: A Brief Overview, 2013, IJERT]
  + Paper 4 : [From Access Control Models to Access Control Metamodels: A Survey, 2019, International Journal of Advanced Networking and Application]

**Literature :**

1. **BASICTCONCEPTSTABOUTTAUTORIZATION**
   1. AuthorizationTmodelsT

TAllTaccessTcontrolTmechanismsTareTbasedTonTsomeTauthorizationTmodel,TwhichTdeﬁnesThowTaTdatabaseTmanagementTsystemTmustTimplementTaccessTcontrol.TItTisTcomposedTofT:

* AccessTgranularityTindication,
* StructuresTtoTrepresentTtheTauthorization,
* ATsetTofTpoliciesTtoTmanageTandTtoTgrantTauthorizationTandT
* AlgorithmsTtoTanalyseTaccessTrequestsTbasedTonTtheTexistingTauthorization.

AccessTgranularityTdeﬁnesTtheTstorageTunitTtoTcontrolTdataTaccessT–Te.g.,TatTtheTtuple,TtablesTorTdatabasesTlevels.TTheTmostTcommonTauthorizationTstructureTisTrepresentedTbyTtheTtripleT<s,To,Tm>,Twhere:TsTisTtheTsubjectTwhoTreceivesTtheTauthorization,ToTtheTobjectTwhichTisTauthorizedTandTmTtheTaccessTmode.

ObjectsToTareTtheTpassiveTentitiesTstoringTinformation,TsuchTasTtables,Ttuples,TorTevenTelementsTofTaTtuple.TSubjectsTareTactiveTentitiesTthatTaccessTtheTobjectsTandTcanTbeTusers,TuserTgroupsTorTprocessesToperatingTonTbehalfTofTusers.TTheTsubjectTcanTalsoTbeTdeﬁnedTinTtermsTofTroles.

TheTmTinT<s,To,Tm>TcorrespondsTtoTtheTaccessTmodeT–Ti.e.,TtheTtypeTofToperationTthatTtheTsubjectThasTpermissionTtoTexecuteTonTtheTobject. DeﬁnedTtheTbasicTsetTofToperationsTas:Tread,Twrite,Tdelete,TexecuteTandTcreate.TAuthorizationsTcanTbeTfurtherTreﬁnedTintoTpositiveTorTnegativeT(forbidden).

TheTsetTofTpoliciesTtoTmanageTauthorizationsTareTrulesTthatTdeﬁne:TwhoTwillTgrantTandTrevokeTpermissionsT(e.g.,Towner,Tadministrator,TanyTuser),ToperationsTauthorizedT(e.g.,Tread,Twrite),TandThowTtheseTwillTbeTexecuted.TPoliciesTalsoTdeﬁneTfactorsTsuchTasTnegativeTauthorizationsTandTauthorizationTderivation.

Finally,TinTorderTtoThaveTaTcompleteTauthorizationTmodel,ToneTmustTalsoTdeﬁneTmechanismsTorTalgorithmsTtoTvalidateTanTaccessTrequestTbasedTonTtheTstoredTauthorizations.TAsTwillTbeTseen,TtheTmechanismTweTproposeTspeciﬁesTallTtheTrequiredTmodelTcomponents:Tgranularity,Tstructure,TpoliciesTandTalgorithms.

1. **ACCESSTCONTROLTMECHANISMST**
   1. **RoleTBasedTAccessTControlT(RBAC)**

RBACTmodelTisTconsideredTasTanTalternativeTapproachTtoTMACTandTDAC.TInTRBAC,TusersTcanTbeTassignedTseveralTrolesTandTaTroleTcanTbeTassociatedTwithTseveralTusersT[4].TATroleTmeansTaTcollectionTofTpermissionsTtoTuseTobjectsTtoTperformTaTjobTfunctionTthatTcombinesTtheTauthorityTandTresponsibilityTassignedTtoTaTsubjectTwhoTplaysTthisTrole,Te.g.Taccountant,Tdirector,Tengineer,Tetc.TeachTroleTisTassociatedTwithTprivilegesTorTpermissionsT.TTheTaimTofTRBACTisTtoTfacilitateTtheTadministrationTofTtheTACTpolicy.TItTgovernsTtheTaccessTofTaTuserTtoTinformationTthroughTrolesTforTwhichTtheTuserTisTauthorizedTtoTperform.TRBACTmodelTisTbasedTonTseveralTentities,TwhichTare,Tusers,Troles,Tpermissions,Tactions,Toperations,TandTobjects.TEachTroleTcanThaveTmanyTpermissionsT,TandTpermissionsTmayTbeTassignedTtoTmanyTroles.TATsubjectTcanToperateTorTplayTmanyTrolesTandTaTroleTcanTbeTperformedTbyTdifferentTsubjects.

ThisTmodelThasTmanyTbenefitsT,TitThasTcentralTadministrationTofTroleTmembershipsTandTACs.TItTmayTalsoTbeTappliedTinTdistributedTareasTbecauseTitTisTbasedTonTtheTconceptTofTconstraintsTandTinherence.TItTalsoThasTsomeTdrawbacks.TItTisTfrequentlyTcriticizedTforTtheTdifficultyTofTsettingTupTanTinitialTroleTstructureTandTforTinflexibilityTinTrapidlyTchangingTITTtechnologies.

* 1. **OrganizationTBasedTAccessTControlT(OrBAC)**

OrganizationTBasedTAccessTControlT(OrBAC)TwasTfirstTmodelledTinT2003.TTheTgoalTofTthisTmodelTisTtoTsolveTsomeTproblemsTinTtheTpreviousTACTmodelsT(DAC,TMACTandTRBAC),TtoTfindTaTmoreTabstractTcontrolTpolicy.TItTisTdesignedTtoTaddressTtheTsubject,TobjectTandTaction,TinTsuchTaTwayTthatTtheTpolicyTdeterminesTwhatTsubject(s)ThasTsomeTaction(s)TtoTaccessTsomeTobject(s).TEachTorganizationT(clinic,Tbanks,ThospitalTetc.)TisTcomprisedTofTaTstructuredTgroupTofTsubjectsThavingTcertainTroles,TorTentities.TThisTmodelTexceedsTtheTconceptTofTonlyTgrantingTpermissionsTtoTsubjects,TitTalsoTaddressesTtheTconceptTofTprohibitions,TobligationsTandTrecommendations.TATroleTmayThaveTaTpermission,TprohibitionTorTobligationTtoTdoTsomeTactivityTonTsomeTviewTgivenTanTassociatedTcontext.TTheTOrBACThasTanTadvantageTinTeliminatingTconflictsTbetweenTsecurityTrules.TItTalsoThasTsomeTvulnerabilitiesTtoTsomeTkindsTofTattacks,Te.g.TcovertTchannels.

* 1. **TemporalTRoleTBasedTAccessTControlT(TRBAC)**

TRBACTisTaTslightTchangeTinTtheTRBAC.TItTsupportsTtemporalTconstraintsTonTtheTrolesTlikeTenabling/disabling.TSuchTconstraintsTareTexecutedTwithTtheThelpTofTcertainTroleTtriggersTandTcanTalsoTbeTusedTtoTconstrainTtheTsetTofTrolesTthatTaTparticularTuserTcanTactivateTatTaTgivenTtimeTinstant.TTheTfiringTofTaTtriggerTmayTcauseTaTroleTtoTbeTenabled/disabledTeitherTimmediately,TorTafterTanTexplicitTspecifiedTamountTofTtime.TTheTmoreTpowerTofTexpressivenessTofTTRBACTleadsTtoTtheTdrawbackTofTambiguityTinTunderstandingTtheTstatusTofTtheTuser’sTroleTatTanyTparticularTtimeTe.g.TtheTuserTmayTbelongTtoTmoreTthanToneTroleTinsteadTofTbasicTroleTbecauseTfiringTofTsomeTtriggers.

* 1. **ReflectiveTDatabaseTAccessTControlT(RDBAC)**

RDBACTisTnewlyTemergingTaccessTcontrolTmodel.TRDBACTtriesTtoTovercomeTtheTdifficultiesTtoTimplementingTtheTcomplexTaccessTcontrolTmodel.TAsTmentionedTearlierTcurrentTdatabasesTuseTaTconceptuallyTsimpleTmodelTforTaccessTcontrolTsuchTasTaccessTcontrolTmatrixTandTdefinitionTofTrolesTetc.TandTbasedTonTthisTtheTusersTareTallowedTtoTperformToperationTi.e.Tread,Tinsert,Tupdate,TorTexecuteTonTdatabaseTresourcesTi.e.Ttables,Tviews,TandTfunctionsTetc.TButTtheseTtechniquesTfaceTweaknessTinTgrantingTaccessTcontrolTatTmoreTfine-grainedTlevelTi.e.TaccessTcontrolTatTcertainTportionsTofTdatabaseTtable.TIfTsuchTlevelTofTaccessTneedsTtoTbeTgrantedTthanTaTseparateTviewTisTtoTbeTcreated,TwhichTcontainsTrequiredTdataTandTthenTtheTuserTisTgrantedTaccessTonTthatTview.TTheseTmodelsTprovideTaThandsomeTflexibilityTinTsomeTcasesTsuchTasTusersTareTallowedTtoTdefineTaccessTprivilegesTforTtheirTownTtables,TwithoutTrequiringTsuperTuserTprivileges.

RDBACTisTaTmodelTinTwhichTaTdatabaseTprivilegeTisTexpressedTasTaTdatabaseTqueryTitself,TratherTthanTasTaTstaticTprivilegeTcontainedTinTanTaccessTcontrolTmatrix.TInTthisTmodelTaccessTcontrolTpolicyTdecisionsTcanTdependTonTdataTcontainedTinTotherTpartsTofTtheTdatabase,TsuchTasTattributesTofTtheTuser,TattributesTofTtheTdataTbeingTqueried,TorTrelationshipsTbetweenTtheTuserTandTtheTdataT.

1. **CASETSTUDY:IMPLEMENTATIONTOFTRDBACTFORTSTUDENTSTRESULTSTINFORMATIONTSYSTEM**

InTthisTcaseTstudyTweTimplementedTtheTprivacyTpoliciesTofTstudentsTresultTinformationTsystem.TThisTsystemTallowsTtheTstudentsTtoTviewTtheirTresultsTasTwellTasTfacilitatesTtheTinstructorsTtoTuploadTtheTresultsTandTalsoTtheTExamTBranchTcoordinatorsTtoTmanageTtheTresults.TTheTadministratorsThaveTaccessTofTtheTwholeTsystemTforTmonitoringTandTmanagement.T

TheTpolicyTwasTimplementedTconsideringTcertainTrulesTandTtheseTruleTwillTbeTreflectedTinTtheTpolicyTitself.

1. **Policies**
   1. GeneralTPurpose
      1. UserTcanTonlyTloginTtoTtheTsystemTifThis/herTstatusTisT“Active”.T
      2. UsersTcanTviewTtheirTownTpersonalTinformationTonly.T
      3. UsersTcanTonlyTupdateTtheirTownTpersonalTandTcontactTinformation.T
      4. DeletionTofTanyTrecordTfromTtheTdatabaseTwillTnotTactuallyTdeleteTtheTrecordTphysicallyTfromTdatabaseTratherTitsTstatusTwouldTbeTmarkedTasTInactive.
   2. PoliciesTforTInstructor
      1. TheTinstructorTcanTonlyTuploadTtheTresultTinformationTofTtheTstudentsTthatTareTenrolledTwithThis/herTcourse.T
      2. TheTinstructorTcanTonlyTviewTtheTresultsTdataTandTtheTcontactTinformationTofTtheTstudentsTthatTareTenrolledTwithTtheTcourseTtaughtTbyTtheTsameTinstructor.T
      3. AnTinstructorTcanTonlyTupdate,TdeleteTtheTresultTdataTofTtheTstudentsTregisteredTwithThis/herTownTcourseTbeforeTtheTresultsTareTmarkedTasTfinalizedTbyTtheTinstructor.T
      4. OnceTtheTstudents’TresultsTareTfinalizedTbyTtheTinstructor,TtheTinstructorTwillTnotTbeTableTtoTchangeTtheTresultsTlater.T
      5. TheTinstructorTcanTalsoTchangeTtheTstatusTofTtheTstudent’sTresultsTinformationTlikeT“ResultTLate”TtoT“Announced”TforTtheTstudentsTenrolledTwithThis/herTcourseTonly.T
      6. OnlyTtheTinstructorTandTtheTAdministratorTcanTviewTtheTcontactTinformationTofTtheTexamTcoordinator.T
      7. TheTinstructorTcanTupdateThis/herTownTcontactTinformationT
      8. TheTinstructorTcanTonlyTsendTtheTresultTinformationTofTaTstudentTviaTemailTonTtheTstudentTrequest,TprovidedTtheTstudentTemailTisTthereTandTitTisTcorrect.
   3. PoliciesTforTStudents
      1. ATstudentTcanTonlyTviewTtheTresultsTofThis/herTownTsubject.T
      2. StudentTcanTviewTtheTcontactTinformationTofTtheTinstructorTofTtheTcourseTwithTwhichThe/sheTisTenrolled.T
      3. StudentTwouldTbeTcapableTofTupdatingThis/herTownTcontactTinformationT
      4. StudentTcanTonlyTcontactTtoTtheTinstructorsTofTtheTsubjectsTtheyThaveTtakenTregardingTanyTresultsTrelatedTissues.T
      5. StudentsTcanTviewTtheTdetailedTresultsTofTotherTstudentsTbeforeTtheTfinalTtermTexams.TTheseTdetailsTincludeTtheTmarksTobtainedTinTmidterm,Tassignments,Tquizzes,TprojectsTetc.
   4. PoliciesTforTExamTCoordinator
      1. ExamTcoordinatorTcanTonlyTviewTtheTresultsTofTallTtheTstudentsTthatTareTcurrentlyTenrolledTwithTanyTsubject.T
      2. ExamTcoordinatorTcanTviewTtheTcontactTinformationTofTtheTinstructorTassociatedTwithTaTcourseTforTanyTtypeTofTgradingTissue.T
      3. TheTexamTcoordinatorTcanTcontactTtoTtheTadministratorTinTcaseTofTanyTissueTinTtheTsystem.T
      4. OnlyTtheTexamTcoordinatorTcanTchangeTtheTstudentTresultsTafterTitTisTmarkedTasTfinalizedTbyTtheTinstructor,TkeepingTinTmindTtheTactionsTareTrecordedTandTwillTbeTauditedTlater.
   5. PoliciesTforTParent/Guardian
      1. Parents/GuardiansTcanTonlyTviewTtheTfinalTresultTandTgradesTofTtheirTownTchildren,TpublishedTatTtheTrequiredTwebsite.T
      2. Parents/GuardiansTcanTonlyTviewTtheTresultTinformationTofTtheirTownTchild,TpublishedTatTtheTwebsite.T
      3. Parent/GuardianTcanTalsoTviewTtheTcontactTinformationTofTtheTinstructorsThavingTtheTcoursesTwithTwhichTtheirTchildrenTareTenrolled.
   6. PoliciesTforTAdministrator
      1. TheTadministratorTcanTviewTallTtheTdataTfromTanyTtableT
      2. TheTadministratorTandTtheTinstructorTcanTonlyTviewTtheTcontactTinformationTofTtheTexamTcoordinator.T
      3. OnlyTtheTadministratorTcanTchangeTtheTstatusTofTtheTusersTfromTActiveTtoTInactiveTandTviceTversa.T
      4. OnlyTtheTadministratorTcanTviewTtheTchangeTlogsTgeneratedTduringTvariousTactionsTperformedTinTtheTsystem.T
      5. OnlyTtheTadministratorTcanTaddTaTnewTuserTinTtheTsystem.T
      6. TheTadministratorTcan’tTchangeTtheTcontactTinformationTofTanyTotherTuserTinTtheTsystem.T
      7. TheTadministratorTcanTonlyTviewTtheTstudents’TresultsTbutTcan’tTchangeTtheTstudents’Tresults.
2. **PoliciesTImplementationTinTRDBAC**
   1. BasicTStatusTPolicyT(Active)
      1. InstructorTisTActive

I*nstructorT(Id,TName,TContact,T..T,T..T,T..T,TIsActive)T*

*e.g.TActiveTinstructorThasTrecordTlikeT(5,TABC,T234,T..T,T..T,T..T,T1)*

* + 1. StudentTisTActive

*StudentT(Id,TFName,TLName,T..T,T..T,TIsActive)T*

*e.g.TActiveTstudentThasTrecordTlikeT(3,TAB,TCD,T..T,T..T,T1)*

* + 1. ExamTcoordinatorTisTActive

*ExamCo(Id,TName,T..T,T..T,TIsActive)T*

*e.g.TActiveTexamTcoordinatorThasTrecordTlikeT(2,TXYZ,T..T,T..T,T1)*

* 1. BasicTAccessTPolicyT(HasAccess)

NowTwhileTimplementingTtheTaccessTpoliciesTthatTwhichTuserTofTtheTsystemTcanTaccessTwhatTsystemTresources.TInstructorTwantsTtoTseeTtheTstudents’Tinformation:

*hasAccess(IID,TSID):-TInstructor(IID,TName,T,T,T1)T*

*Student(SID,TFName,TLName,T,T,T1)T*

*Courses(CID,TCode,TTitle,T,T,TIID,T1)T*

*StudentCourses(SID,TCID,T,T,T)*

ExamTCoordinatorTwantsTtoTseeTtheTstudentTinformation:

*hasAccess(ECID,TSID):-T*

*ExamCo(ECID,TName,T,T,T1)T*

*Student(SID,TFName,TLName,T,T,T1)*

* 1. ContactTPolicy

AsTdescribedTearlier,TaTuserTcanTviewTtheTcontactTinformationTofTotherTusersTasTaccordingTtoTtheTpolicyTenforced.TConsiderTtheTcaseTthatTtheTinstructorTwantsTtoTseeTtheTcontactTinformationTofTtheTstudent,TsoTtheTpolicyTimplementationTwillTbeTasTfollowing:

*View.ContactInfo(FName,TLName,TEmail,TContact,T,T,T):-*

*TInstructor(IID,TName,T,T,T,T1)T*

*Student(SID,TFName,TLName,TEmail,TContact,T,T,T1)T*

*Courses(CID,TCode,TTitle,T,T,TIID,T1)T*

*StudentCourses(SID,TCID,T,T,T)*

* 1. ViewTResultTPolicy

ATstudentTcanTonlyTviewThis/herTownTresults;TalsoTtheTinstructorTcanTviewTtheTresultsTofTallTtheTstudentsTthatTareTenrolledTwithTtheTsubjectTtaughtTbyTtheTsameTinstructor.TTheTExamTCoordinatorTcanTviewTtheTresultsTofTallTtheTactiveTstudentsTenrolledTinTanyTsubject.TParents/GuardiansTcanTalsoTviewTtheTresultTofTtheirTownTchild.TSoTfollowingTareTsomeTpoliciesTimplementationTdescribedTabove.

a)TStudentTResultsTViewT

*View.viewResults(FName,TLName,TCourseName,TMarks,TGrade,TCGPA):-TStudent(SID,TFName,TLName,T1)T*

*Courses(CID,TTitle,1)T*

*StudentCourses(SID,CID,1)T*

*Results(SID,TCID,TMarks,TGrade)T*

b)TInstructorTResultsTView

*TView.viewResults(FName,TLName,TCourseName,TMarks,TGrade,TCGPA):-T*

*Instructor(IID,1)T*

*Student(SID,TFName,TLName,T1)T*

*TCourses(CID,TTitle,TIID,1)T*

*StudentCourses(SID,CID,1)T*

*Results(SID,TCID,TMarks,TGrade)T*

c)TExamTCoordinatorTResultsTViewT

*View.viewResults(FName,TLName,TCourseName,TMarks,TGrade,TCGPA):-T*

*ExamCo(ECID,1)T*

*Student(SID,TFName,TLName,T1)T*

*Courses(CID,TTitle,T1)T*

*StudentCourses(SID,CID,1)T*

*Results(SID,TCID,TMarks,TGrade)T*

d)TParent/GuardiansTResultsTViewTView.viewResults(FName,TLName,TCourseName,TMarks,TGrade,TCGPA):-T

ExamCo(ECID,1)T

Student(SID,TFName,TLName,TPID,T1)T

Courses(CID,TTitle,T1)T

StudentCourses(SID,CID,1)T

Parent(PID,T1)T

Results(SID,TCID,TMarks,TGrade)T

*e)TAdministratorTResultsTViewTView.viewResults(FName,TLName,TCourseName,TMarks,TGrade,TCGPA):-T*

*Admin(AID,1)T*

*Student(SID,TFName,TLName,T1)T*

*Courses(CID,TTitle,T1)T*

*StudentCourses(SID,CID,1)T*

*Results(SID,TCID,TMarks,TGrade)*

* 1. InsertTResultTPolicy

OnlyTtheTinstructorTofTtheTcourseTisTallowedTtoTinsertTtheTresultTofTtheTstudentsTthatTareTenrolledTwithThis/herTcourse.TButTonceTtheTinstructorThasTsubmittedTtheTresultsTtoTtheTexaminationTbranchTthenTtheTinstructorTcan’tTinsertTorTupdateTtheTresults.TInTthisTcaseTtheTinstructorTwillTrequestTtoTtheTExamTCoordinatorTtoTadd/updateTtheTresultTofTanyTstudent.TFollowingTareTtheTpoliciesTimplementationTofTinsertionTofTtheTresults:

a)TInsertTResultsTViewTbyTInstructorT

*View.Ins.sResults(CID,TSID,TMarks,Grade,1)T*

*Results.IsInActive(SID,TCID)T||TResult.NotExist(SID,TCID)T*

*Instructor(IID,T1)T*

*Student(SID,T1)T*

*Courses(CID,TIID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Ins.sResults(SID,TCID,TMarks,TGrade,1)T*

b)TInsertTResultsTViewTbyTExamTCoordinatorT

*View.Ins.sResults(CID,TSID,TMarks,Grade,1)T*

*Results.IsInActive(SID,TCID)T||TResult.NotExist(SID,TCID)T*

*ExamCo(ECID,T1)T*

*Student(SID,T1)T*

*Courses(CID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Ins.sResults(SID,TCID,TMarks,TGrade,1)*

* 1. UpdateTResultTPolicy

OnlyTtheTinstructorTofTtheTcourseTisTallowedTtoTupdateTtheTresultTofTtheTstudentsTthatTareTenrolledTwithThis/herTcourseTandTadditionallyTtheTExamTCoordinatorTcanTalsoTupdateTtheTresultTofTanyTstudentTuponTtheTrequestTfromTtheTinstructorTafterTtheTresultTwasTsubmittedTfinally.

a)TUpdateTResultsTViewTbyTInstructorT

*View.Upd.sResults(CID,TSID,TRID,TMarks,TGrade,T1)T*

*Results.IsActive(SID,TCID,RID,1)T||TResult.Exists(SID,TCID,TRID)T*

*Instructor(IID,T1)T*

*Student(SID,T1)T*

*Courses(CID,TIID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Results(RID,TCID,TSID,T1)T*

*Upd.sResults(SID,TCID,TRID,TMarks,TGrade,T1)T*

b)TUpdateTResultsTViewTbyTExamTCoordinatorT

*View.Upd.sResults(CID,TSID,TRID,TMarks,TGrade,T1)T*

*Results.IsActive(SID,TCID,RID,1)T||TResult.Exists(SID,TCID,TRID,T1)TExamCo(ECID,T1)T*

*Student(SID,T1)T*

*Courses(CID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Results(RID,TCID,TSID,T1)T*

*Upd.sResults(SID,TCID,TRID,TMarks,TGrade,T1)*

* 1. DeleteTResultTPolicy

IfTtheTresultsTareTnotTfinallyTsubmitted,TthenTonlyTtheTinstructorTofTtheTcourseTisTallowedTtoTdeleteTtheTresultTofTtheTstudentsTthatTareTenrolledTwithThis/herTcourse.TIfTtheTresultsTareTsubmittedTinTExaminationTBranchTthenTonlyTtheTExamTCoordinatorTcanTdeleteTtheTstudentTresultTonTtheTrequestTofTinstructor.

a)TDeleteTResultsTViewTbyTInstructorT

*View.Del.sResults(CID,TSID,TRID,TMarks,TGrade,T1)T*

*Results.IsActive(SID,TCID,RID,1)T||TResult.Exists(SID,TCID,TRID,1)TInstructor(IID,T1)T*

*Student(SID,T1)T*

*Courses(CID,TIID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Results(RID,TCID,TSID,T1)T*

*Del.sResults(SID,TCID,TRID,T1)T*

b)TDeleteTResultsTViewTbyTExamTCoordinatorT

*View.Del.sResults(CID,TSID,TRID,TMarks,TGrade,T1)T*

*Results.IsActive(SID,TCID,RID,1)T||TResult.Exists(SID,TCID,TRID,1)TExamCo(ECID,T1)T*

*Student(SID,T1)T*

*Courses(CID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Results(RID,TCID,TSID,T1)T*

*Del.sResults(SID,TCID,TRID,T1)*

1. **ImplementationTofTPoliciesTinTSQL**

PoliciesTthatTareTdefinedTusingTtheTTransactionTdatalogTcanTbeTexpressedTinTstandardTqueryTlanguageT(SQL)TthatTisTunderstandableTforTtheTDBMSs.THereTweTwillTtransformTsomeTofTtheTRDBACTpoliciesTtoTtheTSQLTforTbetterTunderstandingTtheTactualTimplementationTofTtheTRDBACTatTdatabaseTlevel,TassumingTthatTtheTuserTexecutingTtheseTisTActive.

Note : The following queries and the policies mentioned above are taken as it is form the papers. [TRDBAC: Temporal Reflective Database Access Contro, page (340,341,342) ]

*a)TInstructorTwantsTtoTseeTtheTstudents’TcontactTinformationT*

*CreateTViewTView\_Students\_ContactTAST(SELECTTs.FName,Ts.LName,Ts.Address,Ts.CellTFROMTStudentsTsTINNERTJOINTStudentCoursesTscTONTs.SIDT=Tsc.SIDTINNERTJOINTCoursesTcTONTsc.CIDT=Tc.CIDTWHERETc.InstNameT=TCURRENT\_USER)T*

*b)TStudentTwantsTtoTviewTtheTinstructors’TcontactTinformationTCreateTViewTView\_Instructor\_ContactTAST(SELECTTi.Name,Ti.Cell,Ti.EmailTFROMTInstructorTiTINNERTJOINTCoursesTcTONTi.IIDT=Tc.IIDTINNERTJOINTStudentCoursesTscTONTsc.CIDT=Tc.CIDTWHERETsc.SIDT=TCURRENT\_USER)*

*Tc)TExamTCoordinatorTwantsTtoTviewTtheTstudents’TinformationTCreateTViewTView\_StudentsTAST(SELECTTs.FName,Ts.LName,Ts.Email,Ts.Address,Ts.CellTFROMTStudentsTsTINNERTJOINTStudentCoursesTscTONTsc.SIDT=Ts.SID)T*

*d)TStudentTwantsTtoTviewTtheTResultsTCreateTViewTView\_ResultsTAST(SELECTTr.sTitle,Tr.Marks,Tr.GradeTFROMTResultsTrTINNERTJOINTCoursesTcTONTc.CIDT=Tr.CIDTINNERTJOINTStudentCoursesTscTONTsc.CIDT=Tc.SIDTINNERTJOINTStudentsTsTONTs.SIDT=Tsc.SIDTWHERETs.SIDT=TCURRENT\_USER)T*

*e)TInstructorTwantsTtoTviewTtheTstudents’TResultsTCreateTViewTView\_Students\_ResultsTAST(SELECTTr.sTitle,Tr.Marks,Tr.GradeTFROMTResultsTrTINNERTJOINTCoursesTcTONTc.CIDT=Tr.CIDTINNERTJOINTInstructorTiTONTi.IIDT=Tc.IIDTWHERETi.IIDT=TCURRENT\_USER)T*

*f)TParentsTviewTofTtheTstudents’TResultsTCreateTViewTView\_ResultsTAST(SELECTTr.sTitle,Tr.Marks,Tr.GradeTFROMTResultsTrTINNERTJOINTCoursesTcTONTc.CIDT=Tr.CIDTINNERTJOINTStudentsCourseTscTONTsc.SIDT=Tc.CIDTINNERTJOINTStudentsTsTONTs.SIDT=Tsc.SIDTWHERETs.PIDT=TCURRENT\_USER)*

**IMPLEMENTATIONTOFTTRDBACTFORTSTUDENTSTRESULTSTINFORMATIONTSYSTEM**

TheTfollowingTpoliciesTneedTtoTbeTimplementedTusingTtheTtimeTconstraints:TIfTtheTExamTCoordinatorTisTnotTavailableTdueTtoTcertainTreasonTandTaTnecessaryTchangeTinTtheTresultsTisTrequiredTthenTweTmayTallowTtheTinstructorTtoTupdateTtheTresultsTforTaTcertainTtimeTperiod.TForTinstance,TtheTinstructorTisTallowedTtoTupdateTtheTresultsTfromTJuneT28,T2010T9:00TAMTtoTJuneT30,T2010T5:00TPM.TFollowingTisTtheTdescriptionTofTthisTpolicyTinTtransactionTDatalogT(TD)

*View.Upd\_Temporal.sResults(CID,TSID,TRID,TMarks,TGrade,T1)*

*(Results.IsActive(SID,TCID,TRID,T1)T||Results.Exists(SID,TCID,TRID,T1))T&&T!DateExpired(IID,TCurrent\_DateTime)T*

*Instructor(IID,TAdditional\_Role,T‘6/28/2010T9:00:00TAM’,T‘6/30/2010T5:00:00TPM’,T1)TStudent(SID,T1)T*

*Courses(CID,TIID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Results(RID,TCID,TSID,T1)T*

*Upd.sResults(SID,TCID,TRID,TMarks,TGrade,T1)T*

***SQLTImplementation***

*CreateTViewTUpd\_Temporal\_ResultsTAST(UPDATETRESULTSTr,TInstructorTiTSETTr.sTitle=’Title’,Tr.Marks=’Marks’,Tr.Grade=’Grade’TWHERETCURRENT\_DATETIMETBETWEENTi.FromDateTANDTi.ToDateTANDTi.Additional\_Role=1TANDTi.IIDT=TCURRENT\_USER)*

AnotherTscenarioTwhereTweTneedTtoTimplementTtheTTRDBACTisTtoTallowTtheTstudentsTtoTviewTtheTresultsTforTsomeTspecificTtimeTperiodTthenTtheTresultTwillTgoToffline.TForTinstance,TweTsayTthatTtheTstudentsTareTallowedTtoTviewTtheTresultsTfromTJulyT1stT2010T12TAMTtoTJulyT5thT2010T5:00TPM,TandTthenTweThaveTtheTfollowingTpolicyTdescription:

*View.view\_Temporal.sResults(SID,TRID,TMarks,TGrade,T1)T(Results.IsActive(SID,TCID,TRID,T1)T||TResults.Exists(SID,TCID,TRID,T1))T&&T!DateExpired(SID,TCID,TCurrent\_DateTime)T*

*Student(SID,TAdditional\_Role,T‘7/1/2010T00:00:00TAM’,T‘7/1/2010T5:00:00TPM’)T*

*Courses(CID,T1)T*

*StudentCourses(SID,TCID,T1)T*

*Results(RID,TCID,TSID,T1)T*

*View.sResults(SID,TCID,TRID,TMarks,TGrade,T1)*

***SQLTImplementationT***

*CreateTViewTView\_Temporal\_ResultsTAST(SELECTTr.sTitle,Tr.Marks,Tr.GradeTFROMTResultsTrTINNERTJOINTCoursesTcTONTc.CIDT=Tr.CIDTINNERTJOINTStudentCoursesTscTONTsc.CIDT=Tc.SIDTINNERTJOINTStudentsTsTONTs.SIDT=Tsc.SIDTWHERETCURRENT\_DATETIMETBETWEENTs.FromDateTANDTs.ToDateTANDTs.Additional\_Role=1TANDTs.SIDT=TCURRENT\_USER)T*

**CONCLUSION**

DatabaseTsecurityTisTanTimportantTgoalTofTanyTdataTmanagementTsystem.TDatabaseTsecurityTisTbasedTonTthreeTimportantTconstructsTconfidentiality,TintegrityTandTavailability.TAccessTcontrolTmaintainsTaTseparationTbetweenTusersTonToneThandTandTvariousTdataTandTcomputingTresourcesTonTtheTother.TThereTareTthreeTmainTmodelsTofTaccessTcontrol:TDACTmodelTgovernTtheTaccessTtoTdataTonTbasisTofTuser’sTidentityTpredefinedTrulesTbutTareTvulnerableTtoTTrojanThorseTattacks.TMACTmodelsTgovernTtheTaccessTbyTusersTtoTdataTonTtheTbasisTofTclassificationsTassignedTtoTthemTbutTareTtooTrigidTtoTsomeTenvironments.TInTRBACTmodelsTregulateTaccessTonTtheTbasisTofTrolesTuserTplayTinTaTsystem.TRolesTcanTbeTdefinedTasTsetTofTactionsTorTresponsibilitiesTassociatedTwithTaTparticularTworkingTactivity.TRBACTmakesTtheTmanagementTofTpermissionsTeasier,TsupportsTforTprincipleTofTleastTprivilege,TseparationTofTdutiesTetc.TAllTtheTmodelsTareTnotTperfectTandThaveTtheirTownTvulnerabilitiesTthusTmustTbeTchosenTaccordingTtoTtheTneedsTofTorganizations.T

References :

IEEE xplorer and Research Gate