

McGill University Faculty of Management



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Database Project – ACME Simulators

INSY 661 – Database and Distributed Systems for Analytics

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August 19, 2025

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Overview of the Business Scenario

ACME Simulators is a company that provides driving simulators designed to test driving experience across different car models and configuration settings. Its clients range from automobile manufacturers, who require simulators to accurately reflect vehicle configurations, to training organizations that use simulators to evaluate driver performance under varying scenarios.

Clients can freely select a car model, a simulator platform, and their respective configurations to generate a simulator project. Based on these configurations, the company's database system generates a corresponding set of documents. These documents not only verify and validate each simulator build, but can also be integrated into the simulator's workflow, enabling real-time driver prompts for specific maneuvers and immediate assessment of whether the driver's response meets the standard.

Within ACME Simulators, the need to create and update document content results in the generation of new document versions. During this process, different users assume various roles—including authoring, reviewing, locking, and approving—and their actions are systematically recorded in the database system.

Project Scope

Two Major Goals

- ACME will gain a centralized information system to manage documents, track changes, and handle approvals, aiming for full use across all client projects.
- ACME's information system will enable the smooth and flexible development of new client projects and the maintenance of inactive client projects based on accurate data.

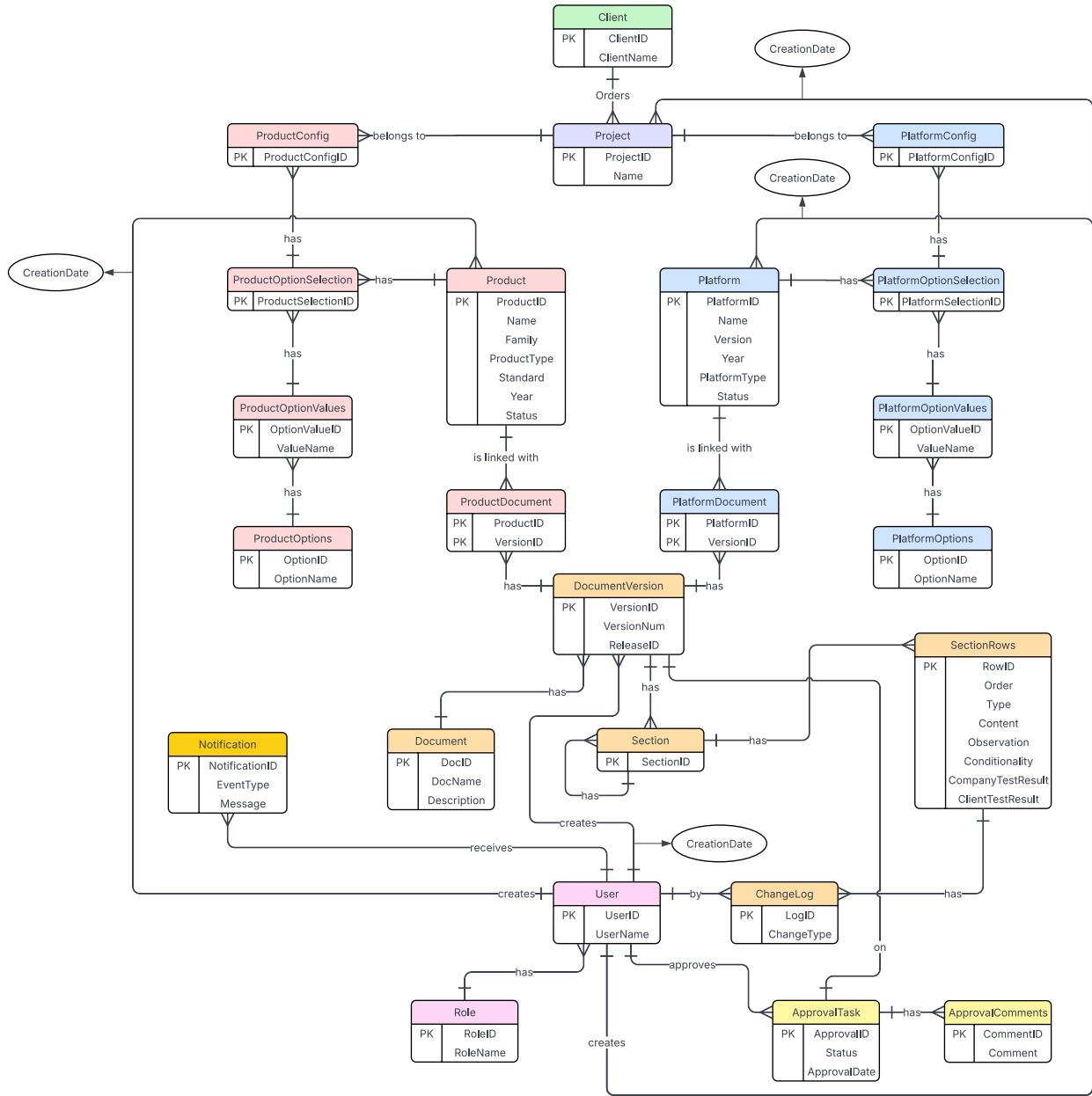
Two User Groups

- ACME employees who author, review, and approve documents related to products and platforms used in client projects.
- Clients who need access to product and platform detailsto create their own personalized projects.

Business Rules

- Only one user can only have one role at the same time.
- Only writer roles can write documents.
- Notifications do not need to refer to documents, versions, products, etc. It was assumed that whenever a user sent a version for review, the “submit for review” button would generate the data related to that notification automatically to populate the notifications table. Therefore, it must only be related to a user.

Entity-Relationship Diagram (ERD)



Data Dictionary

Description of the Entities

Entity Name	Description	Aliases	Occurrence
Client	Contains the information needed to identify a particular client of the company.	<i>c, cl</i>	One client can order many projects.
Project	Contains the information needed to identify a project ordered by a client including which client ordered it as well as the specific configurations chosen and the user ID of the creator of the project	<i>p, proj, prj, pj</i>	One project is ordered by one client and is created by one user. A project has only one product configuration and one platform configuration.
Product	Contains the information needed to identify a product offered by the company as well which user created it.	<i>pr, pc, p, pd</i>	A product is created by one user; it has many product documents and many option selections
ProductOptions	Contains the information needed to identify a specific product option offered by the company.	<i>po</i>	A product option has multiple option values.
ProductOptionValues	Contains the possible (allowable) values an option can take.	<i>pov, e_pov, pdov</i>	A product option value is associated with one product option, and a product option value can be in multiple product option selections

ProductOptionSelection	Combines a product and an option/value pair to define a specific option selection belonging to a specific product.	$pos, ps, pr_os,$ $pos1, pos2$	A product option selection has only one product option value and only one product. A product option selection can be in multiple product configurations.
ProductConfig	Contains information about all the option selections on the selected product chosen by the client as well as which project a configuration belongs to.	$pc, pr_c, pc1,$ $pc2, pcfg, prc$	A product configuration has one product option selection and is in one project.
Platform	Contains the information needed to identify a platform offered by the company as well which user created it.	pl, p	A platform is created by one user; it has many platform documents and many option selections
PlatformOption	Contains the information needed to identify a specific platform option offered by the company.	plo, po	A platform option has multiple option values.
PlatformOptionValues	Contains the possible (allowable) values an option can take.	$plov, pov$	A platform option value is associated with one platform option, and a platform option value can be in multiple platform option selections
PlatformOptionSelection	Combines a platform and an option/value pair to define a specific option selection belonging to a specific platform.	$plos, pl_os,$ $pos2$	A platform option selection has only one platform option value and only one platform. A platform option selection can be

			in multiple platform configurations.
PlatformConfig	Contains information about all the option selections on the selected platform chosen by the client as well as which project a configuration belongs to.	<i>plc, pl_c, plcfg, pc</i>	A platform configuration has one platform option selection and is in one project.
ProductDocument	Contains information relating the products with their respective documents.	<i>pd, prd</i>	A product document belongs to one product and has one version.
PlatformDocument	Contains information relating the platforms with their respective documents.	<i>pld</i>	A platform document belongs to one platform and has one version.
DocumentVersion	Contains information regarding the versioning of a document as well as the user who created it and the approval task related to this version, if applicable.	<i>dv, dv_next, x</i>	A document version is in many product documents and platform documents. A document version is created by one user; it belongs to one document and can have many sections. A document version also has one approval task.
Document	Contains information required to identify documents (without their versions)	<i>d</i>	A document can have many versions.
Section	Contains information required to identify sections, which document version they belong to and which section it belongs to if applicable.	<i>s</i>	A section can have many sections and many rows. A section belongs to one document version.

SectionRows	Contains information about the rows in a section, which section they belong to, as well the purpose, content and test results of the rows.	<i>sr</i>	A section row belongs to one section and can have multiple change logs
ChangeLog	Contains information required to identify a specific change on a row alongside the information to identify the changed row and the user responsible for that change	<i>cl</i>	A change log is related to one section row and is created by one user.
User	Contains the required information to identify a user as well as the role they have in the company.	<i>u</i>	A user has one role, can approve many tasks, can create many change logs and receive many notifications. A user can create many document versions, products, platforms and projects.
Role	Contains information to identify the roles within a company's structure, whether an employee is occupying that role or not.	<i>r</i>	A role can have many users (or none).
Notification	Contains information regarding notifications being sent to users as well as the user who is meant to receive them. The information should identify what type of event it is and which document it concerns.	<i>notif</i>	A notification is received by only one user.
ApprovalTask	Contains information about approval tasks conducted by users on document versions, as well as the information needed to identify which user and version a specific task is related to.	<i>at</i>	An approval task is associated with one user, can have many approval comments and is associated with one document version.

ApprovalComments	Contains the information required to detail comments associated with approval tasks.	<i>ac</i>	An approval comment belongs to one approval task.
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Description of the Attributes

Entity Name	Attributes	Description	Data Type	Nulls	Multi-valued	Derived	Default
Role	RoleID	Unique ID for each role	INT	No	No	No	None
	RoleName	Name of the role	VARCHAR(50)	No	No	No	None
User	UserID	Unique ID for each user	INT	No	No	No	None
	UserName	Name of the user	VARCHAR(100)	No	No	No	None
	RoleID	Foreign key referencing Role(RoleID)	INT	No	No	No	None
Client	ClientID	Unique ID for each client	INT	No	No	No	None
	ClientName	Name of the client	VARCHAR(150)	No	No	No	None
Document	DocID	Unique ID for each document	INT	No	No	No	None
	DocName	Name of the document	VARCHAR(150)	No	No	No	None
	Description	Description of the document	TEXT	No	No	No	None
DocumentVersion	VersionID	Unique ID for each document version	INT	No	No	No	None
	VersionNum	Version number of the document	FLOAT	No	No	No	None
	ReleaseID	Release ID of the document version	INT	No	No	No	None
	DocID	Foreign key referencing Document(DocID)	INT	No	No	No	None
	CreatedBy	Foreign key referencing User(UserID)	INT	No	No	No	None
	CreationDate	Date and time of creation	DATETIME	No	No	No	None
Section	SectionID	Unique ID for each section	INT	No	No	No	None
	ParentSection	Foreign key referencing Section(SectionID)	INT	Yes	No	No	None
	VersionID	Foreign key referencing DocumentVersion(VersionID)	INT	No	No	No	None
SectionRows	RowID	Unique ID for each row	INT	No	No	No	None
	Order	Order of the row	INT	No	No	No	None
	Type	Type of the row content	VARCHAR(50)	No	No	No	None
	Content	Content of the row	VARCHAR(100)	No	No	No	None
	Observation	Observation about the row	VARCHAR(100)	No	No	No	None
	Conditionality	Conditionality of the row	VARCHAR(255)	No	No	No	None
	SectionID	Foreign key referencing Section(SectionID)	INT	No	No	No	None

	CompanyTestResult	Test result from company	VARCHAR(20)	Yes	No	No	None
	ClientTestResult	Test result from client	VARCHAR(20)	Yes	No	No	None
ChangeLog	LogID	Unique ID for each log entry	INT	No	No	No	None
	ChangeType	Type of change	VARCHAR(50)	No	No	No	None
	ChangedBy	Foreign key referencing User(UserID)	INT	No	No	No	None
	RowID	Foreign key referencing SectionRows(RowID)	INT	Yes	No	No	None
ApprovalTask	ApprovalID	Unique ID for each approval task	INT	No	No	No	None
	Status	Status of the approval task	VARCHAR(50)	No	No	No	None
	ApprovalDate	Date of approval	DATE	Yes	No	No	None
	ReviewedBy	Foreign key referencing User(UserID)	INT	Yes	No	No	None
	VersionID	Foreign key referencing DocumentVersion(VersionID)	INT	No	No	No	None
ApprovalComments	CommentID	Unique ID for each comment	INT	No	No	No	None
	Comment	Comment text	TEXT	No	No	No	None
	ApprovalID	Foreign key referencing ApprovalTask(ApprovalID)	INT	No	No	No	None
Notification	NotificationID	Unique ID for each notification	INT	No	No	No	None
	EventType	Type of event	VARCHAR(50)	No	No	No	None
	Message	Message content	TEXT	No	No	No	None
	ReceivedBy	Foreign key referencing User(UserID)	INT	No	No	No	None
ProductOptions	OptionID	Unique ID for each product option	INT	No	No	No	None
	OptionName	Name of the product option	VARCHAR(100)	No	No	No	None
ProductOptionValues	ValueID	Unique ID for each option value	INT	No	No	No	None
	ValueName	Name of the option value	VARCHAR(100)	No	No	No	None
	OptionID	Foreign key referencing ProductOptions(OptionID)	INT	No	No	No	None
PlatformOptions	OptionID	Unique ID for each platform option	INT	No	No	No	None
	OptionName	Name of the platform option	VARCHAR(100)	No	No	No	None
PlatformOptionValues	ValueID	Unique ID for each option value	INT	No	No	No	None
	ValueName	Name of the option value	VARCHAR(100)	No	No	No	None
PlatformOptionValues	OptionID	Foreign key referencing PlatformOptions(OptionID)	INT	No	No	No	None

Product	ProductID	Unique ID for each product	INT	No	No	No	None
	Name	Name of the product	VARCHAR(150)	No	No	No	None
	Family	Family of the product	VARCHAR(100)	No	No	No	None
	ProductType	Type of the product	VARCHAR(50)	No	No	No	None
	Standard	Standard of the product	VARCHAR(50)	No	No	No	None
	Year	Year of the product	YEAR	No	No	No	None
	Status	Status of the product	VARCHAR(50)	No	No	No	None
	CreatedBy	Foreign key referencing User(UserID)	INT	No	No	No	None
	CreationDate	Date and time of creation	DATETIME	No	No	No	None
Platform	PlatformID	Unique ID for each platform	INT	No	No	No	None
	Name	Name of the platform	VARCHAR(150)	No	No	No	None
	Version	Version of the platform	VARCHAR(50)	No	No	No	None
	Year	Year of the platform	YEAR	No	No	No	None
	PlatformType	Type of the platform	VARCHAR(50)	No	No	No	None
	Status	Status of the platform	VARCHAR(50)	No	No	No	None
	CreatedBy	Foreign key referencing User(UserID)	INT	No	No	No	None
	CreationDate	Date and time of creation	DATETIME	No	No	No	None
ProductOptionSelection	ProductOptionSelectionID	Unique ID for each product option selection	INT	No	No	No	None
	ProductID	Foreign key referencing Product(ProductID)	INT	No	No	No	None
	OptionID	Foreign key referencing ProductOptionValues(OptionID)	INT	No	No	No	None
	ValueID	Foreign key referencing ProductOptionValues(ValueID)	INT	No	No	No	None
PlatformOptionSelection	PlatformOptionSelectionID	Unique ID for each platform option selection	INT	No	No	No	None
	PlatformID	Foreign key referencing Platform(PlatformID)	INT	No	No	No	None
	OptionID	Foreign key referencing PlatformOptionValues(OptionI D)	INT	No	No	No	None
	ValueID	Foreign key referencing PlatformOptionValues(ValueID)	INT	No	No	No	None
Project	ProjectID	Unique ID for each project	INT	No	No	No	None

	Name	Name of the project	VARCHAR(150)	No	No	No	None
	CreatedBy	Foreign key referencing User(UserID)	INT	No	No	No	None
	CreationDate	Date and time of creation	DATETIME	No	No	No	None
	RequestedDate	Date the project was requested	DATETIME	No	No	No	None
	ClientID	Foreign key referencing Client(ClientID)	INT	No	No	No	None
ProductConfig	ProjectID	Foreign key referencing Project(ProjectID)	INT	No	No	No	None
	ProductOptionSelectionID	Foreign key referencing ProductOptionSelection(Product OptionSelectionID)	INT	No	No	No	None
PlatformConfig	ProjectID	Foreign key referencing Project(ProjectID)	INT	No	No	No	None
	PlatformOptionSelectionID	Foreign key referencing PlatformOptionSelection(PlatformOptionSelectionID)	INT	No	No	No	None
ProductDocument	ProductID	Foreign key referencing Product(ProductID)	INT	No	No	No	None
	VersionID	Foreign key referencing DocumentVersion(DocumentVersionID)	INT	No	No	No	None
PlatformDocument	PlatformID	Foreign key referencing Platform(PlatformID)	INT	No	No	No	None
	VersionID	Foreign key referencing DocumentVersion(DocumentVersionID)	INT	No	No	No	None

Relational Schema

Role(RoleID, RoleName)

PRIMARY KEY: RoleID

User(userID, UserName, RoleID)

PRIMARY KEY: UserID

FOREIGN KEY: RoleID REFERENCES Role(RoleID)

Client(ClientID, ClientName)

PRIMARY KEY: ClientID

Document(DocID, DocName, Description)

PRIMARY KEY: DocID

DocumentVersion(VersionID, VersionNum, ReleaseID, DocID, CreatedBy, CreationDate)

PRIMARY KEY: VersionID

FOREIGN KEY: DocID REFERENCES Document(DocID)

FOREIGN KEY: CreatedBy REFERENCES User(UserID)

Section(SectionID, ParentSection, VersionID)

PRIMARY KEY: SectionID

FOREIGN KEY: ParentSection REFERENCES Section(SectionID)

FOREIGN KEY: VersionID REFERENCES DocumentVersion(VersionID)

SectionRows(RowID, Order, Type, Content, Observation, Conditionality, SectionID, CompanyTestResult, ClientTestResult)

PRIMARY KEY: RowID

FOREIGN KEY: SectionID REFERENCES Section(SectionID)

ChangeLog(LogID, ChangeType, ChangedBy, RowID)

PRIMARY KEY: LogID

FOREIGN KEY: ChangedBy REFERENCES User(UserID)

FOREIGN KEY: RowID REFERENCES SectionRows(RowID)

ApprovalTask(ApprovalID, Status, ApprovalDate, ReviewedBy, VersionID)

PRIMARY KEY: ApprovalID

FOREIGN KEY: ReviewedBy REFERENCES User(UserID)

FOREIGN KEY: VersionID REFERENCES DocumentVersion(VersionID)

ApprovalComments(CommentID, Comment, ApprovalID)

PRIMARY KEY: CommentID

FOREIGN KEY: ApprovalID REFERENCES ApprovalTask(ApprovalID)

Notification(NotificationID, EventType, Message, ReceivedBy)

PRIMARY KEY: NotificationID

FOREIGN KEY: ReceivedBy REFERENCES User(UserID)

ProductOptions(OptionID, OptionName)

PRIMARY KEY: OptionID

ProductOptionValues(OptionID, ValueID, ValueName)

PRIMARY KEY: OptionID, ValueID

FOREIGN KEY: OptionID REFERENCES ProductOptions(OptionID)

PlatformOptions(OptionID, OptionName)

PRIMARY KEY: OptionID

PlatformOptionValues(OptionID, ValueID, ValueName)

PRIMARY KEY: OptionID, ValueID

FOREIGN KEY: OptionID REFERENCES PlatformOptions(OptionID)

Product(ProductID, Name, Family, ProductType, Standard, Year, Status, CreatedBy, CreationDate)

PRIMARY KEY: ProductID

FOREIGN KEY: CreatedBy REFERENCES User(userID)

Platform(PlatformID, Name, Version, Year, PlatformType, Status, CreatedBy, CreationDate)

PRIMARY KEY: PlatformID

FOREIGN KEY: CreatedBy REFERENCES User(userID)

ProductOptionSelection(ProductOptionSelectionID, ProductID, OptionID, ValueID)

PRIMARY KEY: ProductOptionSelectionID

FOREIGN KEY: ProductID REFERENCES Product(ProductID)

FOREIGN KEY: OptionID, ValueID REFERENCES ProductOptionValues(OptionID, ValueID)

PlatformOptionSelection(PlatformOptionSelectionID, PlatformID, OptionID, ValueID)

PRIMARY KEY: PlatformOptionSelectionID

FOREIGN KEY: PlatformID REFERENCES Platform(PlatformID)

FOREIGN KEY: OptionID, ValueID REFERENCES PlatformOptionValues(OptionID, ValueID)

Project(ProjectID, Name, CreatedBy, CreationDate, RequestedDate, ClientID)

PRIMARY KEY: ProjectID

FOREIGN KEY: CreatedBy REFERENCES User(userID)

FOREIGN KEY: ClientID REFERENCES Client(ClientID)

ProductConfig(ProjectID, ProductOptionSelectionID)

PRIMARY KEY: ProjectID, ProductOptionSelectionID

FOREIGN KEY: ProjectID REFERENCES Project(ProjectID)

FOREIGN KEY: ProductOptionSelectionID REFERENCES
ProductOptionSelection(ProductOptionSelectionID)

PlatformConfig(ProjectID, PlatformOptionSelectionID)

PRIMARY KEY: ProjectID, PlatformOptionSelectionID

FOREIGN KEY: ProjectID REFERENCES Project(ProjectID)

FOREIGN KEY: PlatformOptionSelectionID REFERENCES
PlatformOptionSelection(PlatformOptionSelectionID)

ProductDocument(ProductID, VersionID)

PRIMARY KEY: ProductID, VersionID

FOREIGN KEY: ProductID REFERENCES Product(ProductID)

FOREIGN KEY: VersionID REFERENCES DocumentVersion(VersionID)

PlatformDocument(PlatformID, VersionID)

PRIMARY KEY: PlatformID, VersionID

FOREIGN KEY: PlatformID REFERENCES Platform(PlatformID)

FOREIGN KEY: VersionID REFERENCES DocumentVersion(VersionID)