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[#Copy link](https://ida.interchain.io/academy/2-cosmos-concepts/10-events.html#events) **Events**



Before diving into events, ensure you understand the concepts covered in the following sections:

* [Transactions](https://ida.interchain.io/academy/2-cosmos-concepts/3-transactions.html)
* [Messages](https://ida.interchain.io/academy/2-cosmos-concepts/4-messages.html)
* [Modules](https://ida.interchain.io/academy/2-cosmos-concepts/5-modules.html)
* [Protobuf](https://ida.interchain.io/academy/2-cosmos-concepts/6-protobuf.html)

Code examples are provided at the end of this section, which show events implemented in the checkers blockchain.



Dedicate some time to events in the Cosmos SDK:

* Learn what events are.
* Learn how events are useful.
* Learn how events are implemented in applications.

An event is an object that contains information about the execution of applications. Events are used by service providers like block explorers and wallets to track the execution of various messages and index transactions.

Events are implemented as an alias of the ABCI event type in the form {eventType}.{attributeKey}={attributeValue} in the Cosmos SDK.

Events allow application developers to attach additional information. This means that transactions might be queried using events:



Copy

// Events allow application developers to attach additional information to

// ResponseBeginBlock, ResponseEndBlock, ResponseCheckTx, and ResponseDeliverTx.

// Later, transactions may be queried using these events.

message Event {

string type = 1;

repeated EventAttribute attributes = 2 [

(gogoproto.nullable) = false,

(gogoproto.jsontag) = "attributes,omitempty"

];

}

[#Copy link](https://ida.interchain.io/academy/2-cosmos-concepts/10-events.html#structure) Structure

Two elements stand out in the previous:

* A type to categorize the event at a high level. For example, the Cosmos SDK uses the message *type* to filter events by Msg.
* A list of attributes, which are key-value pairs giving more information on the categorized event. For example, we can filter events by key-value pairs using message.action={some\_action}, message.module={some\_module} or message.sender={a\_sender} for the message type.



Make sure to add ' (single quotes) around each attribute value to parse the attribute values as strings.

Events, their type, and attributes are defined on a per-module basis in the module's /types/events.go file. Each module additionally documents its events under spec/xx\_events.md.

Events are returned to the underlying consensus engine in response to the following ABCI messages:

* BeginBlock
* EndBlock
* CheckTx
* DeliverTx

Events are managed by an abstraction called the EventManager. Events are triggered from the module's Protobuf Msg service with EventManager. This abstraction demands further exploration.

[#Copy link](https://ida.interchain.io/academy/2-cosmos-concepts/10-events.html#eventmanager) EventManager

EventManager tracks a list of events for the entire execution flow of a transaction, or BeginBlock/EndBlock. EventManager implements a simple wrapper around a slice of event objects, which can be emitted from and provide useful methods. The most used method for Cosmos SDK module and application developers is EmitEvent.

Module developers should handle event emission via EventManager#EmitEvent in each message handler and in each BeginBlock or EndBlock handler accessed via the Context. Event emission generally follows this pattern:



Copy

func (em \*EventManager) EmitEvent(event Event) {

em.events = em.events.AppendEvent(event)

}

Each module's handler function should also set a new EventManager to the context to isolate emitted events per message:



Copy

func NewHandler(keeper Keeper) sdk.Handler {

return func(ctx sdk.Context, msg sdk.Msg) (\*sdk.Result, error) {

ctx = ctx.WithEventManager(sdk.NewEventManager())

switch msg := msg.(type) {

// event types

}

...

}

}

[#Copy link](https://ida.interchain.io/academy/2-cosmos-concepts/10-events.html#subscribing-to-events) Subscribing to events

You can use Tendermint's [WebSocket (opens new window)↗](https://docs.tendermint.com/v0.34/tendermint-core/subscription.html) to subscribe to events by calling the subscribe RPC method.

The main eventCategories you can subscribe to are:

* **NewBlock:** contains events triggered during BeginBlock and EndBlock.
* **Tx:** contains events triggered during DeliverTx, the transaction processing.
* **ValidatorSetUpdates:** contains updates about the set of validators for the block.



You can find a full list of event categories in the [Tendermint Go documentation (opens new window)↗](https://godoc.org/github.com/tendermint/tendermint/types#pkg-constants).

You can filter for event types and attribute values. For example, a transfer transaction triggers an event of type Transfer and has Recipient and Sender as attributes, as defined in the events.go file of the bank module.

[#Copy link](https://ida.interchain.io/academy/2-cosmos-concepts/10-events.html#code-example) Code example

****

**Show me some code for my checkers blockchain**

It would be good to document a game's lifecycle via events in your checkers blockchain. For instance, you can emit a specific event such as when creating a game:

Copy

var ctx sdk.Context

ctx.EventManager().EmitEvent(

sdk.NewEvent("new-game-created",

sdk.NewAttribute("creator", msg.Creator),

sdk.NewAttribute("game-index", newIndex),

sdk.NewAttribute("black", msg.Black),

sdk.NewAttribute("red", msg.Red),

sdk.NewAttribute("wager", strconv.FormatUint(msg.Wager, 10)),

sdk.NewAttribute("denom", msg.Denom),

),

)

It is easy to add events to the other transaction types. Events are meant to inform and notify relevant parties.

You should also emit an event for games that have timed out. This is part of their lifecycle after all. You would do that in the end blocker:

Copy

ctx.EventManager().EmitEvent(

sdk.NewEvent("game-forfeited",

sdk.NewAttribute("game-index", gameIndex),

sdk.NewAttribute("winner", storedGame.Winner),

),

)



If you want to go beyond out-of-context code samples like the above and want to see in more detail how to define these features, go to [Run Your Own Cosmos Chain](https://ida.interchain.io/hands-on-exercise/1-ignite-cli/).   
  
More precisely, you can jump to:

* [Emit Game Information](https://ida.interchain.io/hands-on-exercise/1-ignite-cli/7-events.html) to see how to add events to your checkers blockchain
* [Auto-Expiring Games](https://ida.interchain.io/hands-on-exercise/2-ignite-cli-adv/4-game-forfeit.html) to see when this is done in EndBlock
* [Let Players Set a Wager](https://ida.interchain.io/hands-on-exercise/2-ignite-cli-adv/5-game-wager.html) to see how to update your events when adding a new feature
* Tangentially, if you are looking for something akin to events but between modules, look for the hooks pattern in the [Add a leaderboard module](https://ida.interchain.io/hands-on-exercise/4-run-in-prod/3-add-leaderboard.html) section.

synopsis

To summarize, this section has explored:

* How events are objects used by service providers such as block explorers and wallets to track the execution of messages and index transactions by applications.
* The types and attributes of events are defined on a per-module basis and developers can attach additional information to them, so events can be queried or filtered.
* Events are managed, tracked, and triggered by the EventManager abstraction.
* You can subscribe to different categories of event using CometBFT's WebSocket.

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