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[#Copy link](https://ida.interchain.io/hands-on-exercise/5-ibc-adv/7-ibc-app-leaderboard.html#create-a-leaderboard-chain) **Create a Leaderboard Chain**



In this section, you will learn:

* How to create an IBC-enabled chain that can receive information from other chains.
* How to send player scores from your extended checkers chain to a global leaderboard chain via IBC.

After the extension of the checkers chain with a leaderboard module, the checkers game can keep track of player stats and it can maintain (on request) a sorted leaderboard. In addition, it can send player stats via the Inter-Blockchain Communication Protocol (IBC) to another chain.

You will now create a leaderboard chain that can receive the Candidate packets to store in a **global leaderboard**.

Create another folder for your leaderboard chain, and scaffold a chain via Ignite CLI:

**Local**

**Docker**



Copy

$ ignite ignite scaffold chain leaderboard --no-module

Copy

$ docker run --rm -it \

-v $(pwd):/parent \

-w /parent \

ignitehq/cli:0.22.1 \

scaffold chain leaderboard --no-module

Go into it:



Copy

$ cd leaderboard

Again, you can include an IBC-enabled leaderboard module in it:

**Local**

**Docker**



Copy

$ ignite scaffold module leaderboard --ibc

Copy

$ docker run --rm -it \

-v $(pwd):/leaderboard \

-w /leaderboard \

ignitehq/cli:0.22.1 \

scaffold module leaderboard --ibc

You need a structure to keep track of player information too:

**Local**

**Docker**



Copy

$ ignite scaffold map playerInfo \

wonCount:uint lostCount:uint forfeitedCount:uint \

dateUpdated:string \

--module leaderboard \

--no-message

Copy

$ docker run --rm -it \

-v $(pwd):/leaderboard \

-w /leaderboard \

ignitehq/cli:0.22.1 \

scaffold map playerInfo \

wonCount:uint lostCount:uint forfeitedCount:uint \

dateUpdated:string \

--module leaderboard \

--no-message

And of course a board structure:

**Local**

**Docker**



Copy

$ ignite scaffold single board \

PlayerInfo:PlayerInfo \

--module leaderboard \

--no-message

Copy

$ docker run --rm -it \

-v $(pwd):/leaderboard \

-w /leaderboard \

ignitehq/cli:0.22.1 \

scaffold single board \

PlayerInfo:PlayerInfo \

--module leaderboard \

--no-message

In addition, you want to receive candidate packets:

**Local**

**Docker**



Copy

$ ignite scaffold packet candidate \

PlayerInfo:PlayerInfo \

--module leaderboard \

--no-message

Copy

$ docker run --rm -it \

-v $(pwd):/leaderboard \

-w /leaderboard \

ignitehq/cli:0.22.1 \

scaffold packet candidate \

PlayerInfo:PlayerInfo \

--module leaderboard \

--no-message

This time you use the --no-message flag because this chain is not going to send any player information to other chains.



As in the previous section, you need to make adjustments in the Protobuf files proto/leaderboard/board.proto and proto/leaderboard/genesis.proto. Make sure to import gogoproto/gogo.proto and use [(gogoproto.nullable) = false]; for the PlayerInfo and the Board. You will also need to adjust the x/leaderboard/genesis\_test.go like you did in the previous section.

Implement the logic for receiving packets in x/leaderboard/keeper/candidate.go:



Copy

// OnRecvCandidatePacket processes packet reception

func (k Keeper) OnRecvCandidatePacket(ctx sdk.Context, packet channeltypes.Packet, data types.CandidatePacketData) (packetAck types.CandidatePacketAck, err error) {

// validate packet data upon receiving

if err := data.ValidateBasic(); err != nil {

return packetAck, err

}

- // TODO: packet reception logic

+ // Override the entry

+ k.SetPlayerInfo(ctx, \*data.PlayerInfo)

return packetAck, nil

}

modular /

leaderboard /

... /

keeper /

candidate.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/keeper/candidate.go" \l "L77-L78" \t "_blank)

In addition, add a basic validation into x/leaderboard/types/packet\_candidate.go:



Copy

+ import (

+ "errors"

+ )

// ValidateBasic is used for validating the packet

func (p CandidatePacketData) ValidateBasic() error {

- // TODO: Validate the packet data

+ // return error if player info is incorrect

+ playerInfoErr := p.PlayerInfo.ValidateBasic()

+ if playerInfoErr != nil {

+ return playerInfoErr

+ }

return nil

}

modular /

leaderboard /

... /

types /

packet\_candidate.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/types/packet_candidate.go" \l "L10-L14" \t "_blank)

This calls up a new validation on the PlayerInfo, which you also have to declare:



Copy

func (info PlayerInfo) ValidateBasic() error {

\_, err := sdk.AccAddressFromBech32(info.Index)

if err != nil {

return err

}

return nil

}

modular /

leaderboard /

... /

types /

player\_info.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/types/player_info.go" \t "_blank)

Now your leaderboard chain can receive player information from chains with the leaderboard module! However, you need to do some more work in order to update the board on this information.

There are two places where you can call for an update on the board structure:

* In OnRecvCandidatePacket, so each player sending information will pay the fee for sorting and clipping the leaderboard. This is the choice here, for simplicity.
* Or you can change your data structure a little bit and handle the sorting and clipping of the leaderboard in EndBlock.

Here you will extend the x/leaderboard/keeper/candidate.go file in order to call for a leaderboard update in OnRecvCandidatePacket. You need to create some helper functions in a new x/leaderboard/typesboard.go/board.go:



Copy

func ParseDateAddedAsTime(dateAdded string) (dateAddedParsed time.Time, err error) {

dateAddedParsed, errDateAdded := time.Parse(TimeLayout, dateAdded)

return dateAddedParsed, sdkerrors.Wrapf(errDateAdded, ErrInvalidDateAdded.Error(), dateAdded)

}

func SortPlayerInfo(playerInfoList []PlayerInfo) {

sort.SliceStable(playerInfoList[:], func(i, j int) bool {

if playerInfoList[i].WonCount > playerInfoList[j].WonCount {

return true

}

if playerInfoList[i].WonCount < playerInfoList[j].WonCount {

return false

}

firstPlayerTime, \_ := ParseDateAddedAsTime(playerInfoList[i].DateUpdated)

secondPlayerTime, \_ := ParseDateAddedAsTime(playerInfoList[j].DateUpdated)

return firstPlayerTime.After(secondPlayerTime)

})

}

modular /

leaderboard /

... /

types /

board.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/types/board.go" \t "_blank)

And in x/leaderboard/keeper/board.go, introduce a new UpdateBoard function:



Copy

func (k Keeper) UpdateBoard(ctx sdk.Context, playerInfoList []types.PlayerInfo) {

SortPlayerInfo(playerInfoList)

if types.LeaderboardWinnerLength < uint64(len(playerInfoList)) {

playerInfoList = playerInfoList[:types.LeaderboardWinnerLength]

}

k.SetBoard(ctx, types.Board {

PlayerInfo: playerInfoList,

})

}

modular /

leaderboard /

... /

keeper /

board.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/keeper/board.go" \l "L36-L46" \t "_blank)

Again, do not forget to declare the new error type in x/leaderboard/types/errors.go:



Copy

ErrInvalidDateAdded = sdkerrors.Register(ModuleName, 1120, "dateAdded cannot be parsed: %s")

modular /

leaderboard /

... /

types /

errors.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/types/errors.go" \l "L14" \t "_blank)

You also need to define TimeLayout in x/leaderboard/types/keys.go:



Copy

TimeLayout = "2006-01-02 15:04:05.999999999 +0000 UTC"

modular /

leaderboard /

... /

types /

keys.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/types/keys.go" \l "L40" \t "_blank)

Then you can include a call to UpdateBoard call in x/leaderboard/keeper/candidate.go:



Copy

// OnRecvCandidatePacket processes packet reception

func (k Keeper) OnRecvCandidatePacket(ctx sdk.Context, packet channeltypes.Packet, data types.CandidatePacketData) (packetAck types.CandidatePacketAck, err error) {

...

k.SetPlayerInfo(ctx, \*data.PlayerInfo)

+ // Update the board

+ board, found := k.GetBoard(ctx)

+ if !found {

+ panic("Leaderboard not found")

+ }

+ listed := board.PlayerInfo

+ replaced := false

+ for i := range listed {

+ if listed[i].Index == data.PlayerInfo.Index {

+ listed[i] = \*data.PlayerInfo

+ replaced = true

+ break

+ }

+ }

+ if !replaced {

+ listed = append(listed, \*data.PlayerInfo)

+ }

+ k.UpdateBoard(ctx, listed)

return packetAck, nil

}

modular /

leaderboard /

... /

keeper /

candidate.go

[View source→](https://github.com/b9lab/cosmos-ibc-docker/blob/main/modular/leaderboard/x/leaderboard/keeper/candidate.go" \l "L80-L97" \t "_blank)

With this, your leaderboard chain is ready to update its leaderboard when receiving a candidate packet.

[#Copy link](https://ida.interchain.io/hands-on-exercise/5-ibc-adv/7-ibc-app-leaderboard.html#test-it) Test it

You can find the sample implementation of the checkers chain extension and the leaderboard chain in [this repository (opens new window)↗](https://github.com/b9lab/cosmos-ibc-docker/tree/main/modular). There you will also find a Docker network and the relayer settings for an easy test. It also includes a script to create and run games.

Follow the steps described in the repository to run a few tests and to see it in action. If you want to do the tests with your chains, replace modular/b9-checkers-academy-draft with your checkers chain and modular/leaderboard with your leaderboard chain, and build the docker images.

previous

[](https://ida.interchain.io/hands-on-exercise/5-ibc-adv/6-ibc-app-checkers.html)

**[Extend the Checkers Game With a Leaderboard](https://ida.interchain.io/hands-on-exercise/5-ibc-adv/6-ibc-app-checkers.html)**

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