JS Class Diagram

1. TypeScript-STL
2. Collection
3. Library
4. **Protocol**
5. Examples

TypeScript-STL

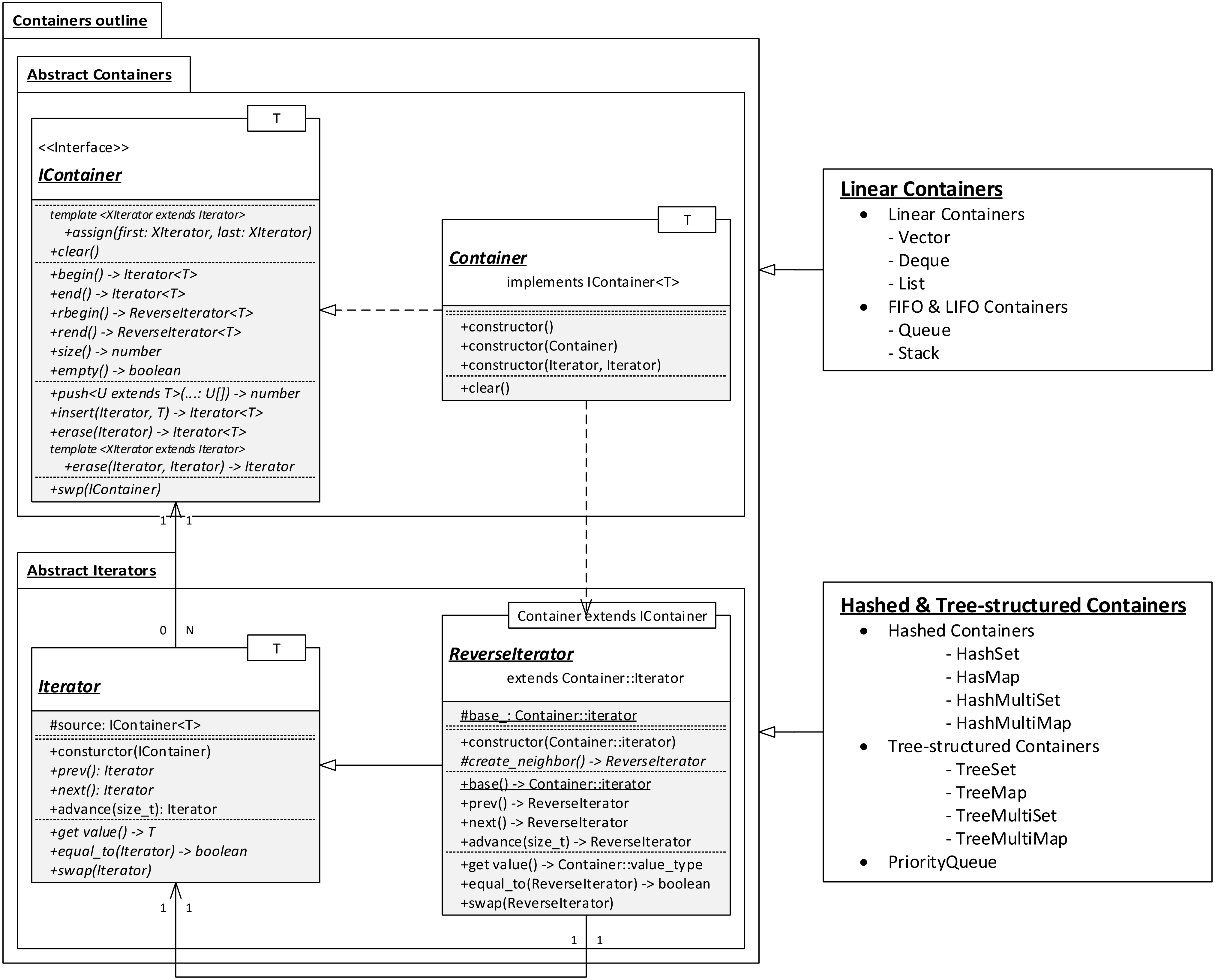
TypeScript-STL (Standard Template Library)

Basics

Linear Containers

Set Containers

Map Containers



Containers outline

Abstract Containers

T

<<Interface>>

IContainer

template <XIterator extends Iterator>
+assign(first: XIterator, last: XIterator)
+clear()

+begin() -> Iterator<T>
+end() -> Iterator<T>
+rbegin() -> ReverseIterator<T>
+rend() -> ReverseIterator<T>
+size() -> number
+empty() -> boolean

+push<U extends T>(...: U[]) -> number
+insert(Iterator, T) -> Iterator<T>
+erase(Iterator) -> Iterator<T>
template <XIterator extends Iterator>
+erase(Iterator, Iterator) -> Iterator

+swp(IContainer)

T

Container

implements IContainer<T>

+constructor()
+constructor(Container)
+constructor(Iterator, Iterator)

+clear()

Abstract Iterators

1 1

0 N

T

Iterator

#source: IContainer<T>

+consturctor(IContainer)
+prev(): Iterator
+next(): Iterator
+advance(size_t): Iterator

+get value() -> T
+equal_to(Iterator) -> boolean
+swap(Iterator)

1 1

Container extends IContainer

ReverseIterator

extends Container::Iterator

#base_: Container::iterator

+constructor(Container::iterator)
#create_neighbor() -> ReverseIterator

+base() -> Container::iterator
+prev() -> ReverseIterator
+next() -> ReverseIterator
+advance(size_t) -> ReverseIterator

+get value() -> Container::value_type
+equal_to(ReverseIterator) -> boolean
+swap(ReverseIterator)

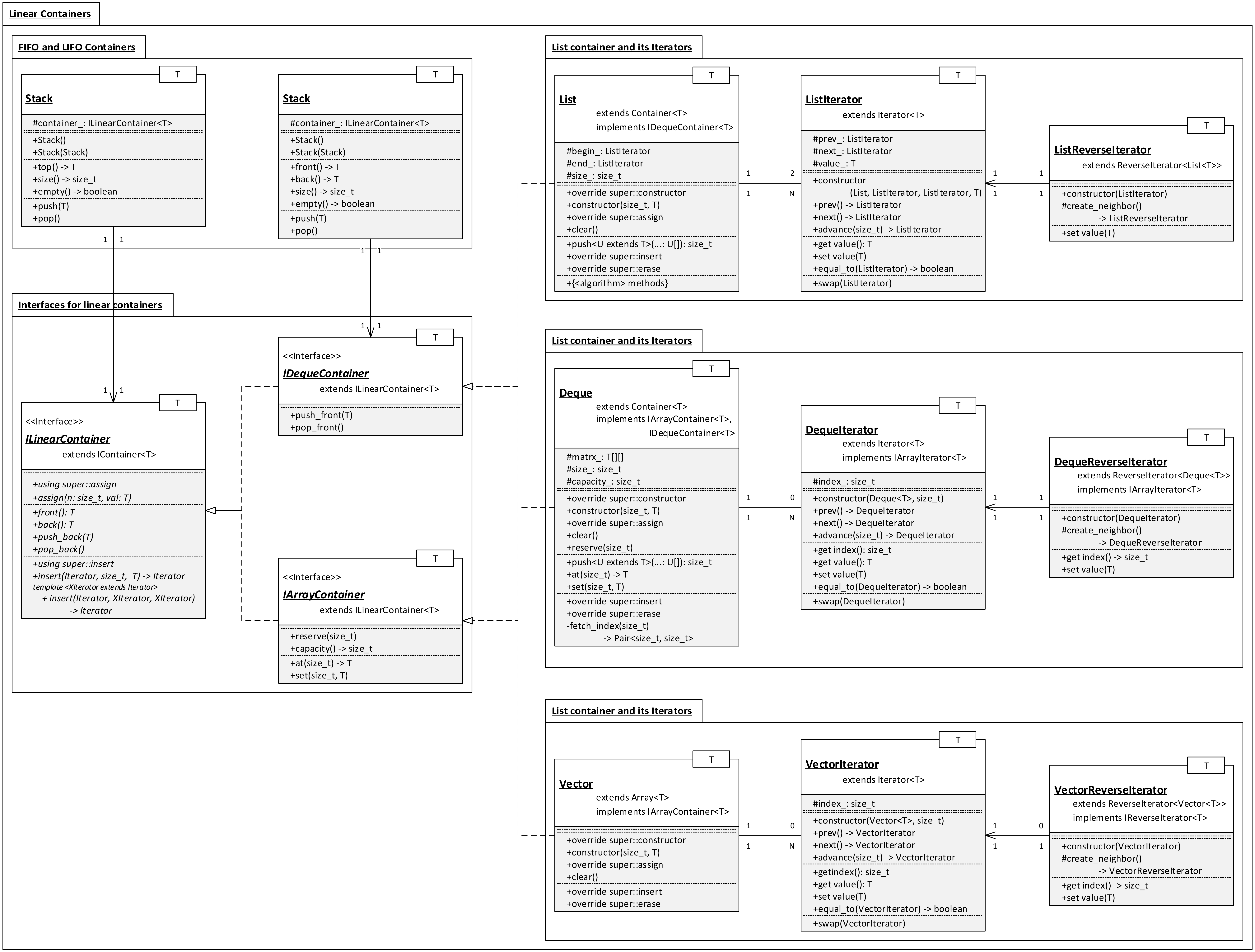
1 1

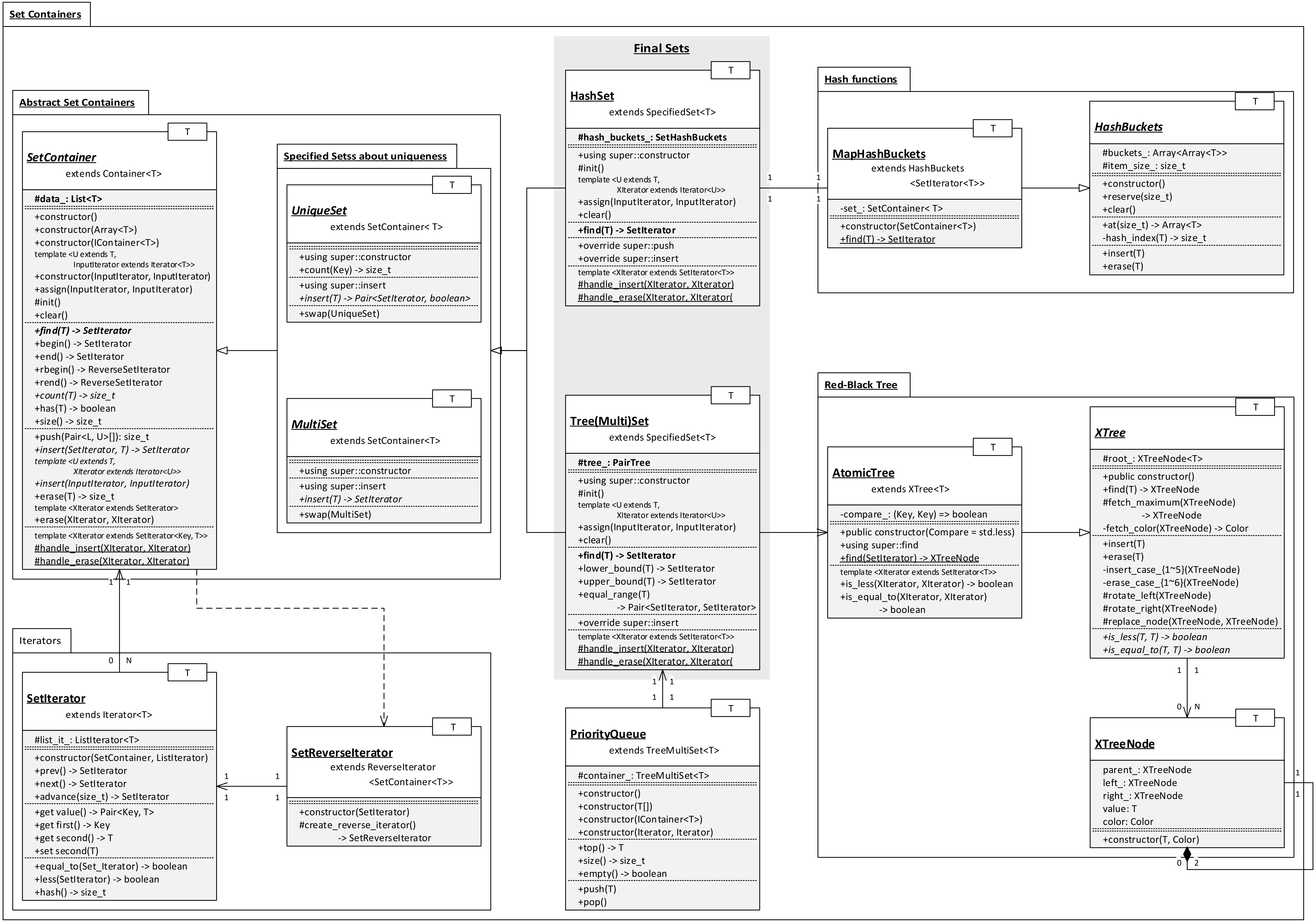
Linear Containers

- Linear Containers
  - Vector
  - Deque
  - List
- FIFO & LIFO Containers
  - Queue
  - Stack

Hashed & Tree-structured Containers

- Hashed Containers
  - HashSet
  - HasMap
  - HashMultiSet
  - HashMultiMap
- Tree-structured Containers
  - TreeSet
  - TreeMap
  - TreeMultiSet
  - TreeMultiMap
- PriorityQueue


Linear Containers
FIFO and LIFO Containers
T
Stack
#container_: ILinearContainer<T>
+Stack()
+Stack(Stack)
+top() -> T
+size() -> size_t
+empty() -> boolean
+push(T)
+pop()
T
Stack
#container_: ILinearContainer<T>
+Stack()
+Stack(Stack)
+front() -> T
+back() -> T
+size() -> size_t
+empty() -> boolean
+push(T)
+pop()
1 1
1 1
Interfaces for linear containers
1 1
1 1
T
<<Interface>>
IDequeContainer
extends ILinearContainer<T>
+push_front(T)
+pop_front()
T
<<Interface>>
ILinearContainer
extends IContainer<T>
+using super::assign
+assign(n: size_t, val: T)
+front(): T
+back(): T
+push_back(T)
+pop_back()
+using super::insert
+insert(Iterator, size_t, T) -> Iterator
template <XIterator extends Iterator>
+ insert(Iterator, XIterator, XIterator)
-> Iterator
T
<<Interface>>
IArrayContainer
extends ILinearContainer<T>
+reserve(size_t)
+capacity() -> size_t
+at(size_t) -> T
+set(size_t, T)
List container and its Iterators
T
List
extends Container<T>
implements IDequeContainer<T>
#begin_: ListIterator
#end_: ListIterator
#size_: size_t
+override super::constructor
+constructor(size_t, T)
+override super::assign
+clear()
+push<U extends T>(...: U[]): size_t
+override super::insert
+override super::erase
+{<algorithm> methods}
1 2
1 N
T
ListIterator
extends Iterator<T>
#prev_: ListIterator
#next_: ListIterator
#value_: T
+constructor
(List, ListIterator, ListIterator, T)
+prev() -> ListIterator
+next() -> ListIterator
+advance(size_t) -> ListIterator
+get value(): T
+set value(T)
+equal_to(ListIterator) -> boolean
+swap(ListIterator)
1 1
1 1
T
ListReverseIterator
extends ReverseIterator<List<T>>
+constructor(ListIterator)
#create_neighbor()
-> ListReverseIterator
+set value(T)
List container and its Iterators
T
Deque
extends Container<T>
implements IArrayContainer<T>,
IDequeContainer<T>
#matrx_: T[][]
#size_: size_t
#capacity_: size_t
+override super::constructor
+constructor(size_t, T)
+override super::assign
+clear()
+reserve(size_t)
+push<U extends T>(...: U[]): size_t
+at(size_t) -> T
+set(size_t, T)
+override super::insert
+override super::erase
-fetch_index(size_t)
-> Pair<size_t, size_t>
1 0
1 N
T
DequeIterator
extends Iterator<T>
implements IArrayIterator<T>
#index_: size_t
+constructor(Deque<T>, size_t)
+prev() -> DequeIterator
+next() -> DequeIterator
+advance(size_t) -> DequeIterator
+get index(): size_t
+get value(): T
+set value(T)
+equal_to(DequeIterator) -> boolean
+swap(DequeIterator)
1 1
1 1
T
DequeReverseIterator
extends ReverseIterator<Deque<T>>
implements IArrayIterator<T>
+constructor(DequeIterator)
#create_neighbor()
-> DequeReverseIterator
+get index() -> size_t
+set value(T)
List container and its Iterators
T
Vector
extends Array<T>
implements IArrayContainer<T>
+override super::constructor
+constructor(size_t, T)
+override super::assign
+clear()
+override super::insert
+override super::erase
1 0
1 N
T
VectorIterator
extends Iterator<T>
#index_: size_t
+constructor(Vector<T>, size_t)
+prev() -> VectorIterator
+next() -> VectorIterator
+advance(size_t) -> VectorIterator
+getindex(): size_t
+get value(): T
+set value(T)
+equal_to(VectorIterator) -> boolean
+swap(VectorIterator)
1 0
1 1
T
VectorReverseIterator
extends ReverseIterator<Vector<T>>
implements IReverseIterator<T>
+constructor(VectorIterator)
#create_neighbor()
-> VectorReverseIterator
+get index() -> size_t
+set value(T)



Abstract Set Containers

SetContainer (T)
extends Container<T>

#data_: List<T>

+constructor()
+constructor(Array<T>)
+constructor(IContainer<T>)
template <U extends T,
InputIterator extends Iterator<T>>
+constructor(InputIterator, InputIterator)
+assign(InputIterator, InputIterator)
#init()
+clear()

+find(T) -> SetIterator
+begin() -> SetIterator
+end() -> SetIterator
+rbegin() -> ReverseSetIterator
+rend() -> ReverseSetIterator
+count(T) -> size_t
+has(T) -> boolean
+size() -> size_t

+push(Pair<L, U>[]): size_t
+insert(SetIterator, T) -> SetIterator
template <U extends T,
XIterator extends Iterator<U>>
+insert(InputIterator, InputIterator)
+erase(T) -> size_t
template <XIterator extends SetIterator>
+erase(XIterator, XIterator)

template <XIterator extends SetIterator<Key, T>>
#handle_insert(XIterator, XIterator)
#handle_erase(XIterator, XIterator)

Specified Setss about uniqueness

UniqueSet (T)
extends SetContainer< T>

+using super::constructor
+count(Key) -> size_t

+using super::insert
+insert(T) -> Pair<SetIterator, boolean>

+swap(UniqueSet)

MultiSet (T)
extends SetContainer<T>

+using super::constructor

+using super::insert
+insert(T) -> SetIterator

+swap(MultiSet)

Iterators

SetIterator (T)
extends Iterator<T>

#list_it_: ListIterator<T>

+constructor(SetContainer, ListIterator)
+prev() -> SetIterator
+next() -> SetIterator
+advance(size_t) -> SetIterator

+get value() -> Pair<Key, T>
+get first() -> Key
+get second() -> T
+set second(T)

+equal_to(Set_Iterator) -> boolean
+less(SetIterator) -> boolean
+hash() -> size_t

SetReverseIterator (T)
extends ReverseIterator
<SetContainer<T>>

+constructor(SetIterator)
#create_reverse_iterator()
-> SetReverseIterator

Final Sets

HashSet (T)
extends SpecifiedSet<T>

#hash_buckets_: SetHashBuckets

+using super::constructor
#init()
template <U extends T,
XIterator extends Iterator<U>>
+assign(InputIterator, InputIterator)
+clear()

+find(T) -> SetIterator

+override super::push
+override super::insert

template <XIterator extends SetIterator<T>>
#handle_insert(XIterator, XIterator)
#handle_erase(XIterator, XIterator(

Tree(Multi)Set (T)
extends SpecifiedSet<T>

#tree_: PairTree

+using super::constructor
#init()
template <U extends T,
XIterator extends Iterator<U>>
+assign(InputIterator, InputIterator)
+clear()

+find(T) -> SetIterator
+lower_bound(T) -> SetIterator
+upper_bound(T) -> SetIterator
+equal_range(T)
-> Pair<SetIterator, SetIterator>

+override super::insert

template <XIterator extends SetIterator<T>>
#handle_insert(XIterator, XIterator)
#handle_erase(XIterator, XIterator(

PriorityQueue (T)
extends TreeMultiSet<T>

#container_: TreeMultiSet<T>

+constructor()
+constructor(T[])
+constructor(IContainer<T>)
+constructor(Iterator, Iterator)

+top() -> T
+size() -> size_t
+empty() -> boolean

+push(T)
+pop()

Hash functions

MapHashBuckets (T)
extends HashBuckets
<SetIterator<T>>

-set_: SetContainer< T>

+constructor(SetContainer<T>)
+find(T) -> SetIterator

HashBuckets (T)

#buckets_: Array<Array<T>>
#item_size_: size_t

+constructor()
+reserve(size_t)
+clear()

+at(size_t) -> Array<T>
-hash_index(T) -> size_t

+insert(T)
+erase(T)

Red-Black Tree

AtomicTree (T)
extends XTree<T>

-compare_: (Key, Key) => boolean

+public constructor(Compare = std.less)
+using super::find
+find(SetIterator) -> XTreeNode

template <XIterator extends SetIterator<T>>
+is_less(XIterator, XIterator) -> boolean
+is_equal_to(XIterator, XIterator)
-> boolean

XTree (T)

#root_: XTreeNode<T>

+public constructor()
+find(T) -> XTreeNode
#fetch_maximum(XTreeNode)
-> XTreeNode
-fetch_color(XTreeNode) -> Color

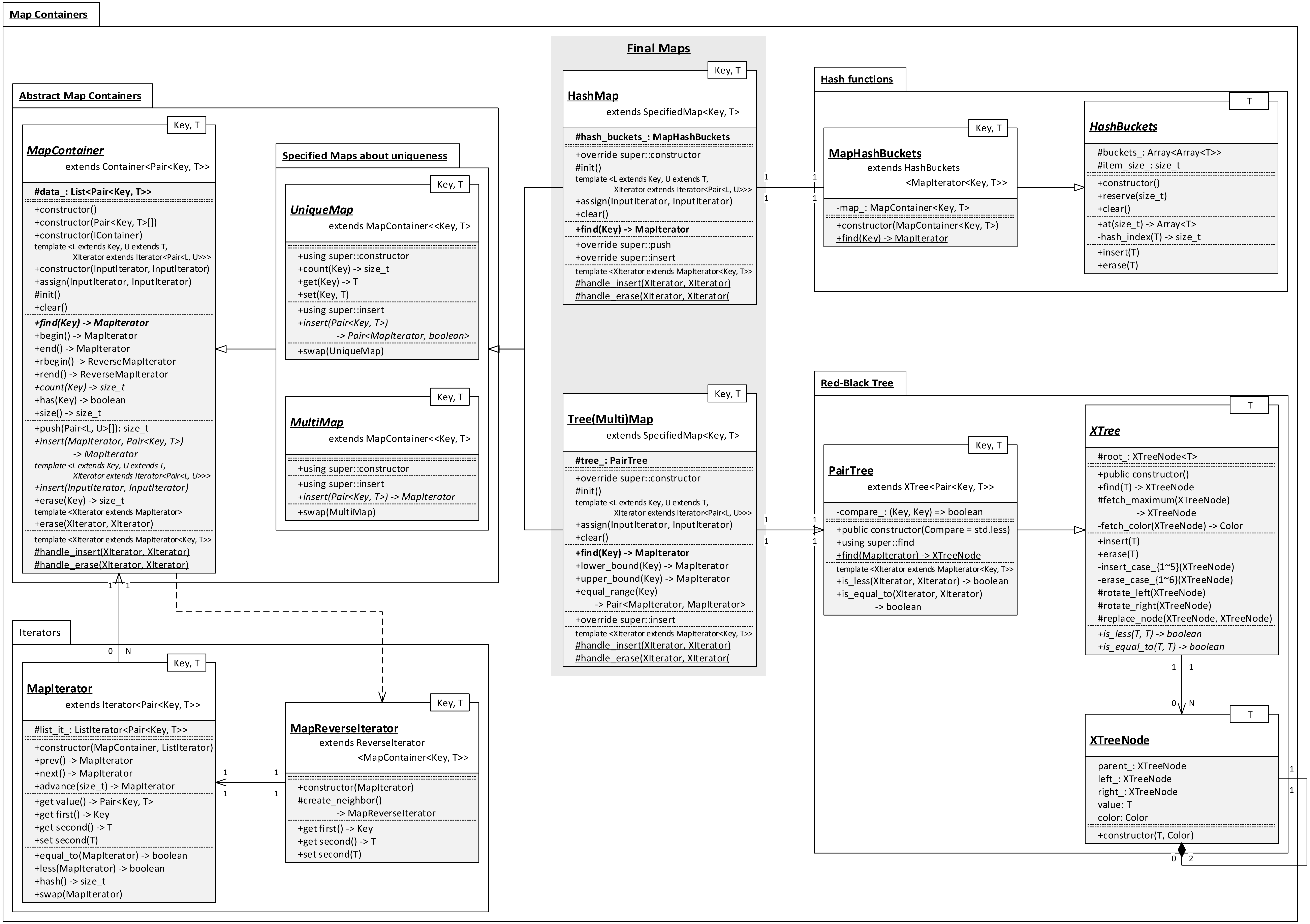
+insert(T)
+erase(T)
-insert_case_{1~5}(XTreeNode)
-erase_case_{1~6}(XTreeNode)
#rotate_left(XTreeNode)
#rotate_right(XTreeNode)
#replace_node(XTreeNode, XTreeNode)

+is_less(T, T) -> boolean
+is_equal_to(T, T) -> boolean

XTreeNode (T)

parent_: XTreeNode
left_: XTreeNode
right_: XTreeNode
value: T
color: Color

+constructor(T, Color)



Map Containers

Abstract Map Containers

Key, T
MapContainer
extends Container<Pair<Key, T>>
#data_: List<Pair<Key, T>>
+constructor()
+constructor(Pair<Key, T>[])
+constructor(IContainer)
template <L extends Key, U extends T,
XIterator extends Iterator<Pair<L, U>>>
+constructor(InputIterator, InputIterator)
+assign(InputIterator, InputIterator)
#init()
+clear()
+find(Key) -> MapIterator
+begin() -> MapIterator
+end() -> MapIterator
+rbegin() -> ReverseMapIterator
+rend() -> ReverseMapIterator
+count(Key) -> size_t
+has(Key) -> boolean
+size() -> size_t
+push(Pair<L, U>[]): size_t
+insert(MapIterator, Pair<Key, T>)
-> MapIterator
template <L extends Key, U extends T,
XIterator extends Iterator<Pair<L, U>>>
+insert(InputIterator, InputIterator)
+erase(Key) -> size_t
template <XIterator extends MapIterator>
+erase(XIterator, XIterator)
template <XIterator extends MapIterator<Key, T>>
#handle_insert(XIterator, XIterator)
#handle_erase(XIterator, XIterator)

Specified Maps about uniqueness

Key, T
UniqueMap
extends MapContainer<<Key, T>
+using super::constructor
+count(Key) -> size_t
+get(Key) -> T
+set(Key, T)
+using super::insert
+insert(Pair<Key, T>)
-> Pair<MapIterator, boolean>
+swap(UniqueMap)

Key, T
MultiMap
extends MapContainer<<Key, T>
+using super::constructor
+using super::insert
+insert(Pair<Key, T>) -> MapIterator
+swap(MultiMap)

Iterators

Key, T
MapIterator
extends Iterator<Pair<Key, T>>
#list_it_: ListIterator<Pair<Key, T>>
+constructor(MapContainer, ListIterator)
+prev() -> MapIterator
+next() -> MapIterator
+advance(size_t) -> MapIterator
+get value() -> Pair<Key, T>
+get first() -> Key
+get second() -> T
+set second(T)
+equal_to(MapIterator) -> boolean
+less(MapIterator) -> boolean
+hash() -> size_t
+swap(MapIterator)

Key, T
MapReverseIterator
extends ReverseIterator
<MapContainer<Key, T>>
+constructor(MapIterator)
#create_neighbor()
-> MapReverseIterator
+get first() -> Key
+get second() -> T
+set second(T)

Final Maps

Key, T
HashMap
extends SpecifiedMap<Key, T>
#hash_buckets_: MapHashBuckets
+override super::constructor
#init()
template <L extends Key, U extends T,
XIterator extends Iterator<Pair<L, U>>>
+assign(InputIterator, InputIterator)
+clear()
+find(Key) -> MapIterator
+override super::push
+override super::insert
template <XIterator extends MapIterator<Key, T>>
#handle_insert(XIterator, XIterator)
#handle_erase(XIterator, XIterator(

Key, T
Tree(Multi)Map
extends SpecifiedMap<Key, T>
#tree_: PairTree
+override super::constructor
#init()
template <L extends Key, U extends T,
XIterator extends Iterator<Pair<L, U>>>
+assign(InputIterator, InputIterator)
+clear()
+find(Key) -> MapIterator
+lower_bound(Key) -> MapIterator
+upper_bound(Key) -> MapIterator
+equal_range(Key)
-> Pair<MapIterator, MapIterator>
+override super::insert
template <XIterator extends MapIterator<Key, T>>
#handle_insert(XIterator, XIterator)
#handle_erase(XIterator, XIterator(

Hash functions

Key, T
MapHashBuckets
extends HashBuckets
<MapIterator<Key, T>>
-map_: MapContainer<Key, T>
+constructor(MapContainer<Key, T>)
+find(Key) -> MapIterator

T
HashBuckets
#buckets_: Array<Array<T>>
#item_size_: size_t
+constructor()
+reserve(size_t)
+clear()
+at(size_t) -> Array<T>
-hash_index(T) -> size_t
+insert(T)
+erase(T)

Red-Black Tree

Key, T
PairTree
extends XTree<Pair<Key, T>>
-compare_: (Key, Key) => boolean
+public constructor(Compare = std.less)
+using super::find
+find(MapIterator) -> XTreeNode
template <XIterator extends MapIterator<Key, T>>
+is_less(XIterator, XIterator) -> boolean
+is_equal_to(XIterator, XIterator)
-> boolean

T
XTree
#root_: XTreeNode<T>
+public constructor()
+find(T) -> XTreeNode
#fetch_maximum(XTreeNode)
-> XTreeNode
-fetch_color(XTreeNode) -> Color
+insert(T)
+erase(T)
-insert_case_{1~5}(XTreeNode)
-erase_case_{1~6}(XTreeNode)
#rotate_left(XTreeNode)
#rotate_right(XTreeNode)
#replace_node(XTreeNode, XTreeNode)
+is_less(T, T) -> boolean
+is_equal_to(T, T) -> boolean

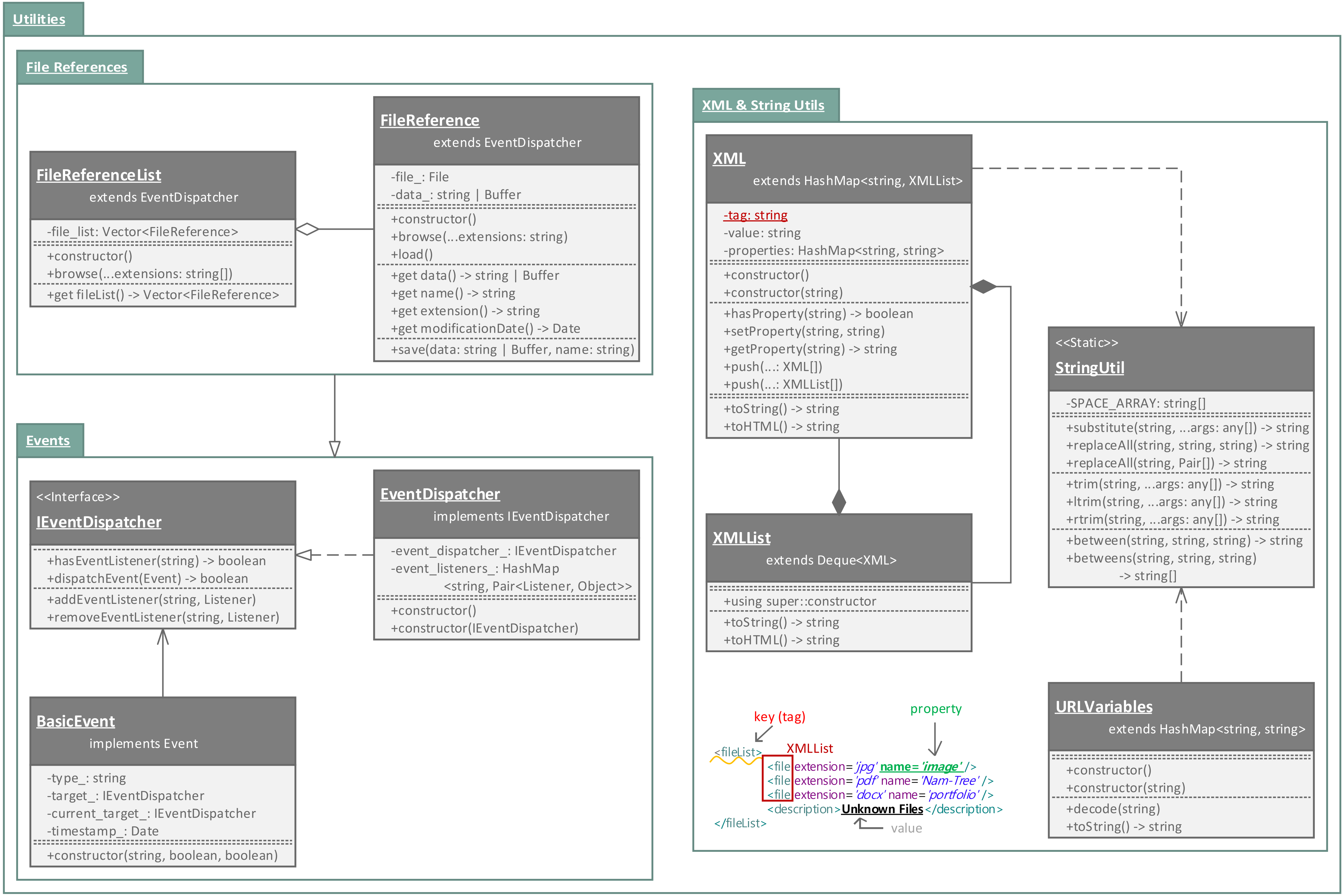
T
XTreeNode
parent_: XTreeNode
left_: XTreeNode
right_: XTreeNode
value: T
color: Color
+constructor(T, Color)

Library

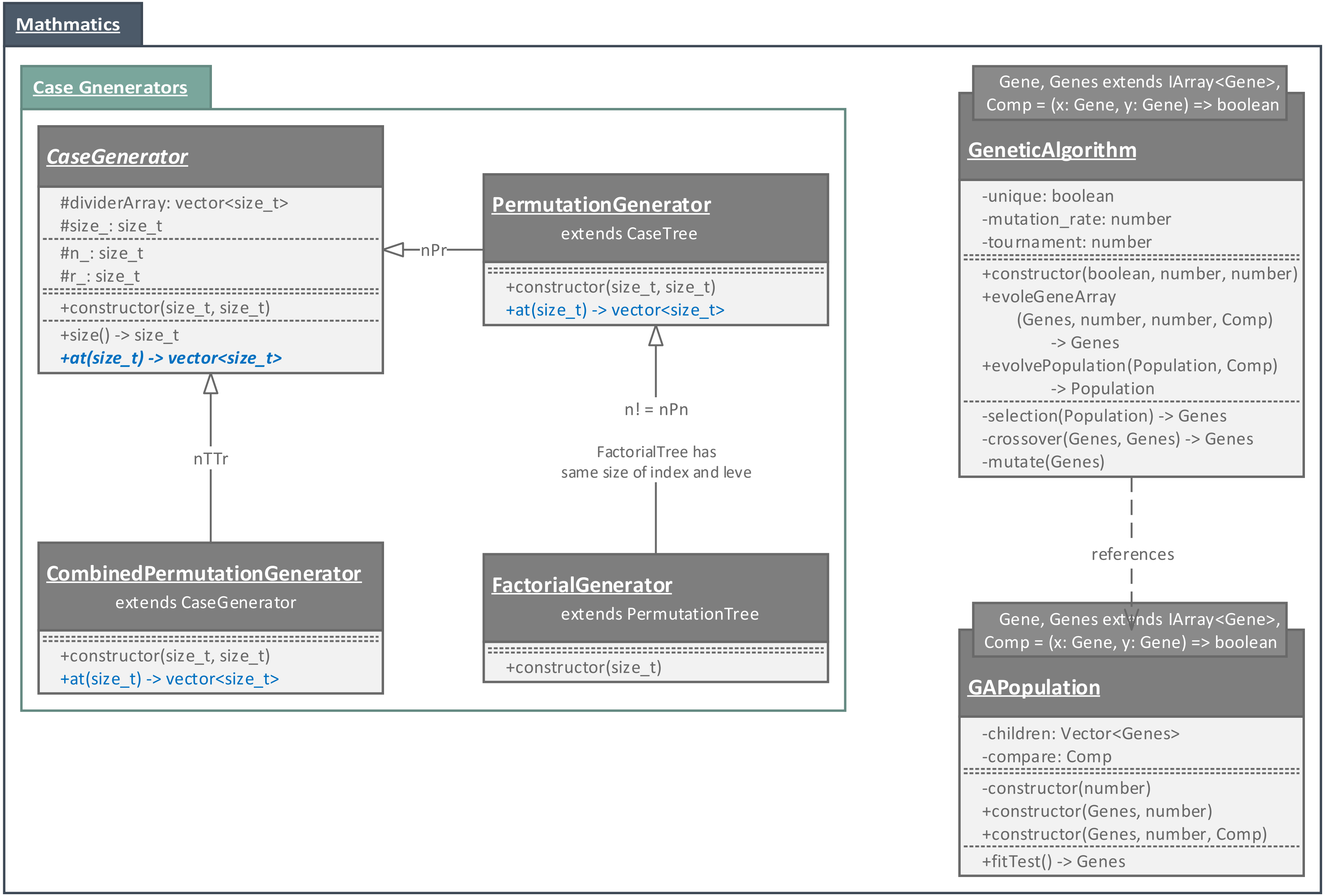
Helpful library objects

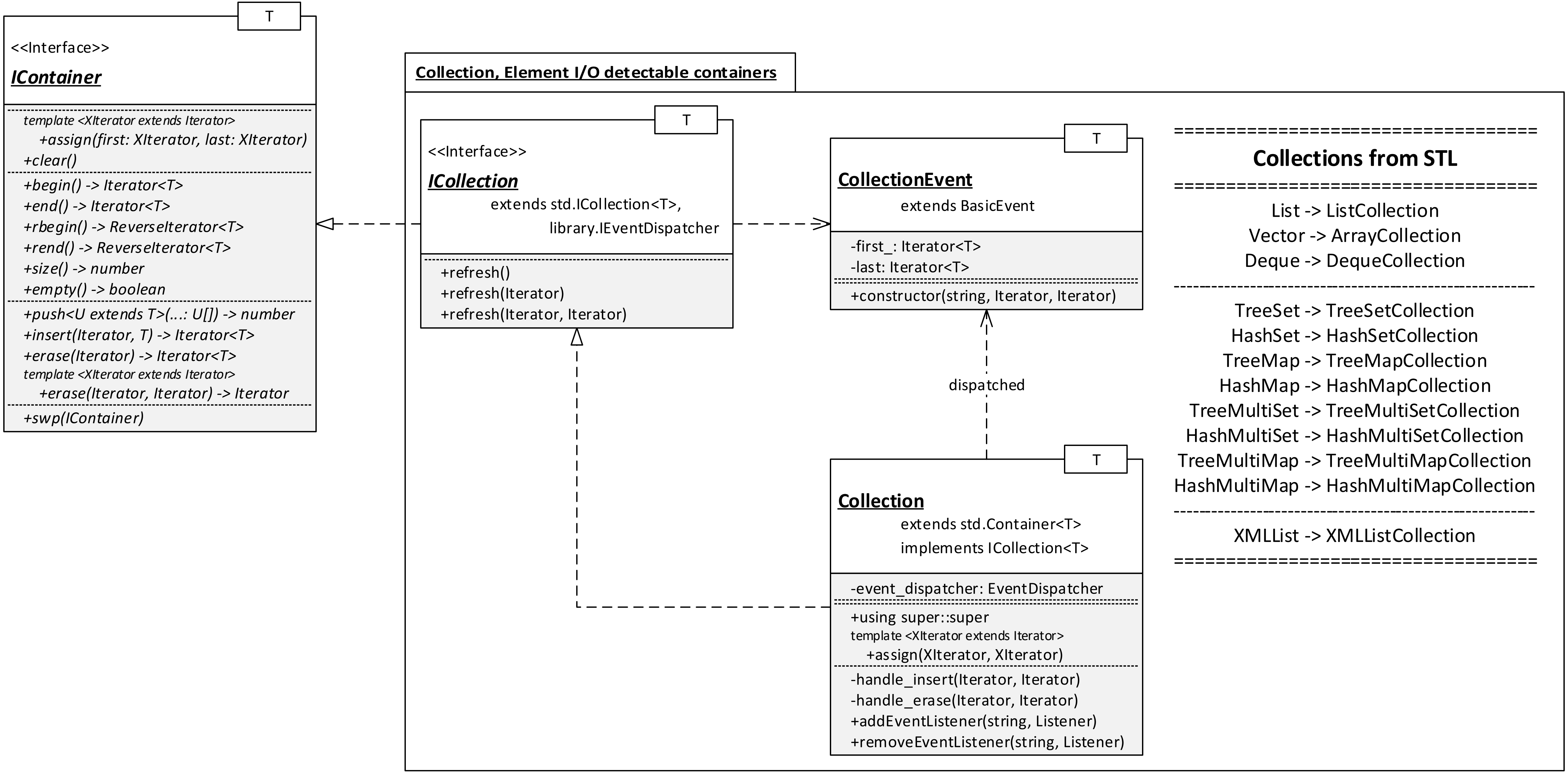
Utilities

Mathematics


Utilities
File References
FileReferenceList
extends EventDispatcher
-file_list: Vector<FileReference>
+constructor()
+browse(...extensions: string[])
+get fileList() -> Vector<FileReference>
FileReference
extends EventDispatcher
-file_: File
-data_: string | Buffer
+constructor()
+browse(...extensions: string)
+load()
+get data() -> string | Buffer
+get name() -> string
+get extension() -> string
+get modificationDate() -> Date
+save(data: string | Buffer, name: string)
Events
<<Interface>>
IEventDispatcher
+hasEventListener(string) -> boolean
+dispatchEvent(Event) -> boolean
+addEventListener(string, Listener)
+removeEventListener(string, Listener)
EventDispatcher
implements IEventDispatcher
-event_dispatcher_: IEventDispatcher
-event_listeners_: HashMap
<string, Pair<Listener, Object>>
+constructor()
+constructor(IEventDispatcher)
BasicEvent
implements Event
-type_: string
-target_: IEventDispatcher
-current_target_: IEventDispatcher
-timestamp_: Date
+constructor(string, boolean, boolean)
XML & String Utils
XML
extends HashMap<string, XMLList>
-tag: string
-value: string
-properties: HashMap<string, string>
+constructor()
+constructor(string)
+hasProperty(string) -> boolean
+setProperty(string, string)
+getProperty(string) -> string
+push(...: XML[])
+push(...: XMLList[])
+toString() -> string
+toHTML() -> string
XMLList
extends Deque<XML>
+using super::constructor
+toString() -> string
+toHTML() -> string
<<Static>>
StringUtil
-SPACE_ARRAY: string[]
+substitute(string, ...args: any[]) -> string
+replaceAll(string, string, string) -> string
+replaceAll(string, Pair[]) -> string
+trim(string, ...args: any[]) -> string
+ltrim(string, ...args: any[]) -> string
+rtrim(string, ...args: any[]) -> string
+between(string, string, string) -> string
+betweens(string, string, string)
-> string[]
URLVariables
extends HashMap<string, string>
+constructor()
+constructor(string)
+decode(string)
+toString() -> string
key (tag)
property
XMLList
value

```
<fileList>
    <file extension='jpg' name='image' />
    <file extension='pdf' name='Nam-Tree' />
    <file extension='docx' name='portfolio' />
    <description>Unknown Files</description>
</fileList>
```

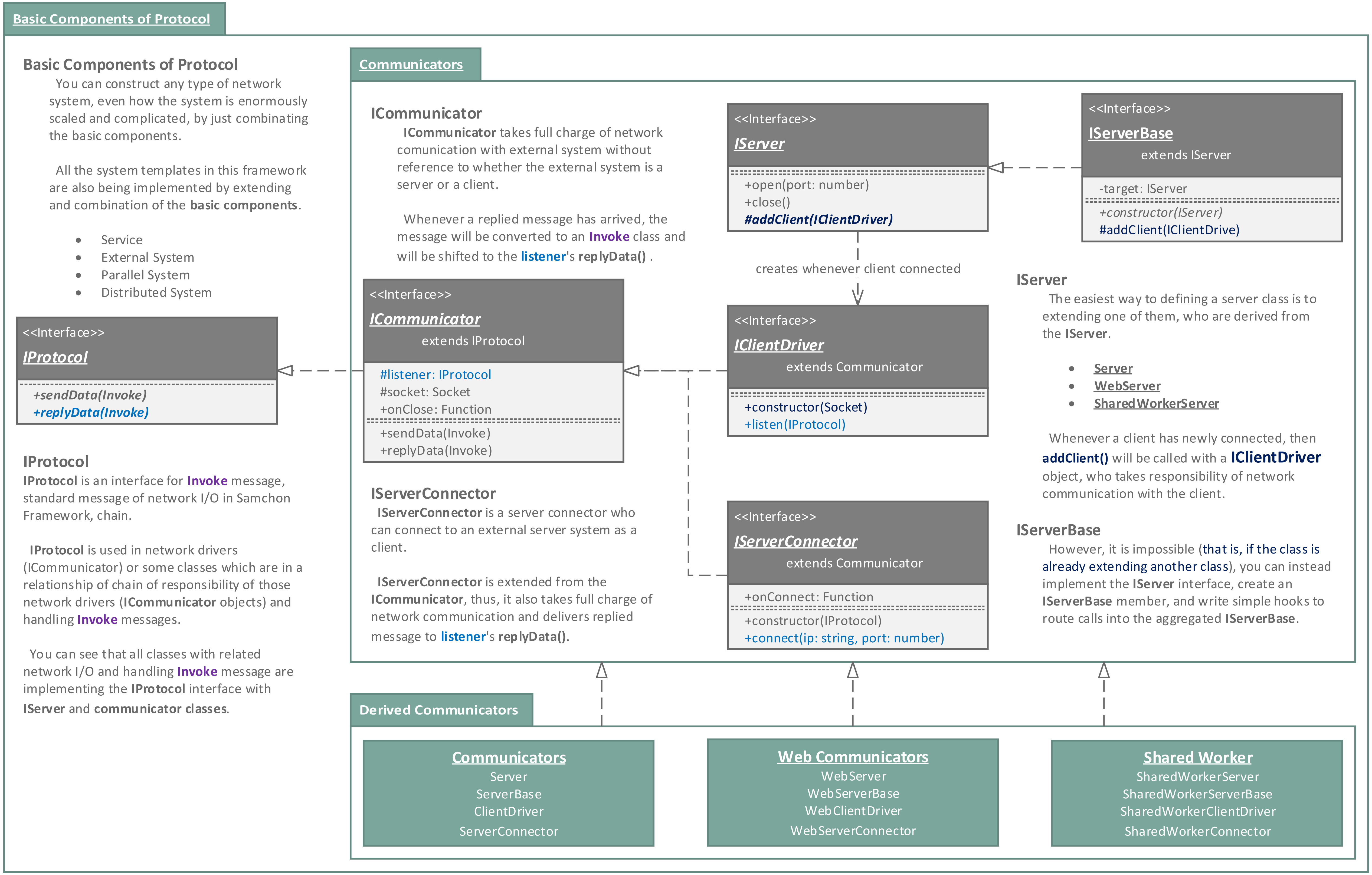

Mathmatics
Case Gnenerators
CaseGenerator
#dividerArray: vector<size_t>
#size_: size_t
#n_: size_t
#r_: size_t
+constructor(size_t, size_t)
+size() -> size_t
+at(size_t) -> vector<size_t>
nPr
PermutationGenerator
extends CaseTree
+constructor(size_t, size_t)
+at(size_t) -> vector<size_t>
nTTr
n! = nPn
FactorialTree has
same size of index and leve
CombinedPermutationGenerator
extends CaseGenerator
+constructor(size_t, size_t)
+at(size_t) -> vector<size_t>
FactorialGenerator
extends PermutationTree
+constructor(size_t)
Gene, Genes extends IArray<Gene>,
Comp = (x: Gene, y: Gene) => boolean
GeneticAlgorithm
-unique: boolean
-mutation_rate: number
-tournament: number
+constructor(boolean, number, number)
+evoleGeneArray
(Genes, number, number, Comp)
-> Genes
+evolvePopulation(Population, Comp)
-> Population
-selection(Population) -> Genes
-crossover(Genes, Genes) -> Genes
-mutate(Genes)
references
Gene, Genes extends IArray<Gene>,
Comp = (x: Gene, y: Gene) => boolean
GAPopulation
-children: Vector<Genes>
-compare: Comp
-constructor(number)
+constructor(Genes, number)
+constructor(Genes, number, Comp)
+fitTest() -> Genes


T
<<Interface>>
IContainer
template <XIterator extends Iterator>
+assign(first: XIterator, last: XIterator)
+clear()
+begin() -> Iterator<T>
+end() -> Iterator<T>
+rbegin() -> ReverseIterator<T>
+rend() -> ReverseIterator<T>
+size() -> number
+empty() -> boolean
+push<U extends T>(...: U[]) -> number
+insert(Iterator, T) -> Iterator<T>
+erase(Iterator) -> Iterator<T>
template <XIterator extends Iterator>
+erase(Iterator, Iterator) -> Iterator
+swp(IContainer)
Collection, Element I/O detectable containers
T
<<Interface>>
ICollection
extends std.ICollection<T>,
library.IEventDispatcher
+refresh()
+refresh(Iterator)
+refresh(Iterator, Iterator)
T
CollectionEvent
extends BasicEvent
-first_: Iterator<T>
-last: Iterator<T>
+constructor(string, Iterator, Iterator)
dispatched
T
Collection
extends std.Container<T>
implements ICollection<T>
-event_dispatcher: EventDispatcher
+using super::super
template <XIterator extends Iterator>
+assign(XIterator, XIterator)
-handle_insert(Iterator, Iterator)
-handle_erase(Iterator, Iterator)
+addEventListener(string, Listener)
+removeEventListener(string, Listener)
=====================================
Collections from STL
=====================================
List -> ListCollection
Vector -> ArrayCollection
Deque -> DequeCollection
TreeSet -> TreeSetCollection
HashSet -> HashSetCollection
TreeMap -> TreeMapCollection
HashMap -> HashMapCollection
TreeMultiSet -> TreeMultiSetCollection
HashMultiSet -> HashMultiSetCollection
TreeMultiMap -> TreeMultiMapCollection
HashMultiMap -> HashMultiMapCollection
XMLList -> XMLListCollection
=====================================

Protocol

Integration in network level

Message Protocol
Basic Components
Cloud Service
External System
Parallel Processing System
Distributed Processing System



Basic Components of Protocol

Basic Components of Protocol

You can construct any type of network system, even how the system is enormously scaled and complicated, by just combinating the basic components.

All the system templates in this framework are also being implemented by extending and combination of the **basic components**.

- Service
- External System
- Parallel System
- Distributed System

<<Interface>>
IProtocol

+sendData(Invoke)
+replyData(Invoke)

IProtocol

IProtocol is an interface for **Invoke** message, standard message of network I/O in Samchon Framework, chain.

IProtocol is used in network drivers (ICommunicator) or some classes which are in a relationship of chain of responsibility of those network drivers (**ICommunicator** objects) and handling **Invoke** messages.

You can see that all classes with related network I/O and handling **Invoke** message are implementing the **IProtocol** interface with **IServer** and **communicator classes**.

Communicators

ICommunicator

ICommunicator takes full charge of network comunication with external system without reference to whether the external system is a server or a client.

Whenever a replied message has arrived, the message will be converted to an **Invoke** class and will be shifted to the **listener**'s **replyData()** .

<<Interface>>
ICommunicator
extends IProtocol

#listener: IProtocol
#socket: Socket
+onClose: Function

+sendData(Invoke)
+replyData(Invoke)

IServerConnector

IServerConnector is a server connector who can connect to an external server system as a client.

IServerConnector is extended from the **ICommunicator**, thus, it also takes full charge of network communication and delivers replied message to **listener**'s **replyData()**.

<<Interface>>
IServer

+open(port: number)
+close()
#addClient(IClientDriver)

creates whenever client connected

<<Interface>>
IClientDriver
extends Communicator

+constructor(Socket)
+listen(IProtocol)

<<Interface>>
IServerConnector
extends Communicator

+onConnect: Function

+constructor(IProtocol)
+connect(ip: string, port: number)

<<Interface>>
IServerBase
extends IServer

-target: IServer

+constructor(IServer)
#addClient(IClientDrive)

IServer

The easiest way to defining a server class is to extending one of them, who are derived from the **IServer**.

- Server
- WebServer
- SharedWorkerServer

Whenever a client has newly connected, then **addClient()** will be called with a **IClientDriver** object, who takes responsibility of network communication with the client.

IServerBase

However, it is impossible (that is, if the class is already extending another class), you can instead implement the **IServer** interface, create an **IServerBase** member, and write simple hooks to route calls into the aggregated **IServerBase**.

Derived Communicators

Communicators
Server
ServerBase
ClientDriver
ServerConnector

Web Communicators
WebServer
WebServerBase
WebClientDriver
WebServerConnector

Shared Worker
SharedWorkerServer
SharedWorkerServerBase
SharedWorkerClientDriver
SharedWorkerConnector

Message Protocol

Entity Module

Entity is

To standardize expression method of data structure.
Entity provides I/O interfaces to/from XML object.
When you need some additional function for the Entity, use the chain responsibility pattern like **IEntityChain**.

Hierarchical Relationship

Compose the data class(entity) having children by inheriting IEntityGroup or IEntityCollection, and terminate the leaf node by inheriting Entity.

Just define the XML I/O only for each variables, then about the data I/O, all will be done

Pre-defined Entity classes

Single Entity

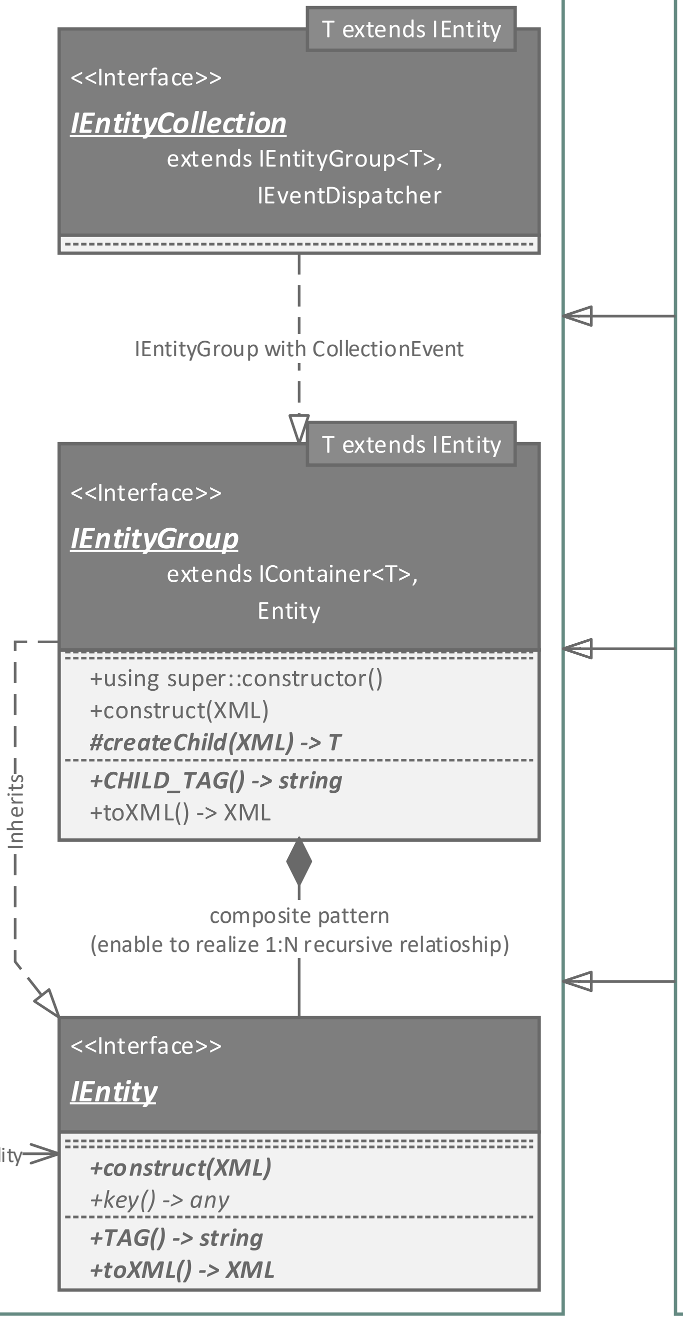
- Entity

IEntityGroup

- EntityArray extend std.Vector
- EntityList extends std.List
- EntityDeque extends std.Deque

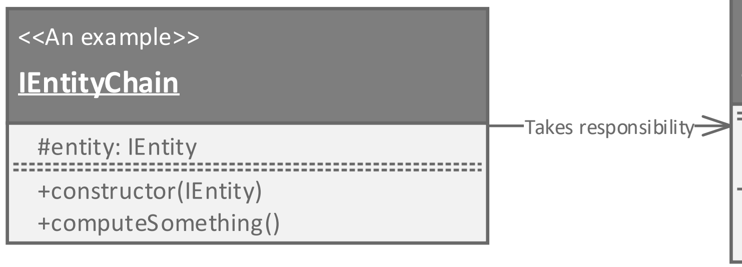
IEntityCollection

- EntityArrayCollection extends ArrayCollection
- EntityListCollection extends ListCollection
- EntityDequeCollection extends DequeCollection

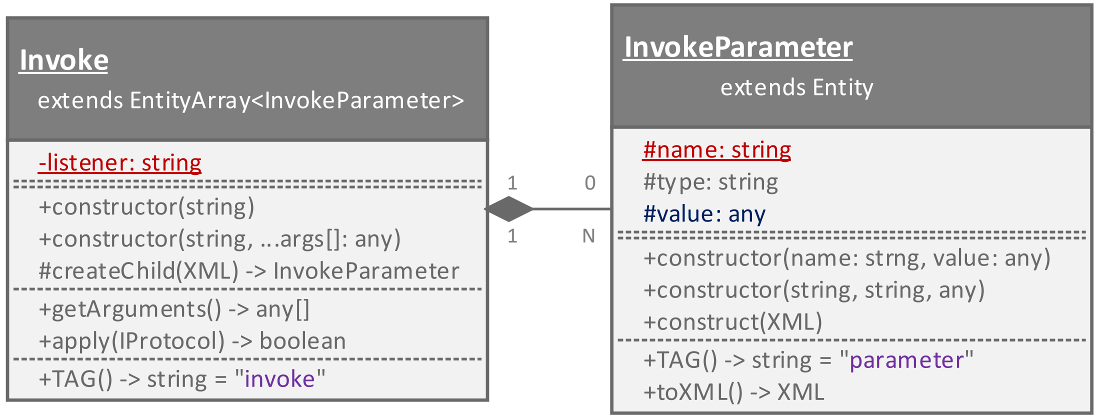


Chain of Responsibility

In my framework, Entity is the main character,
so that concentrates on to the Entity and its members 1st.
Procedures and computations related to the Entity are later.



Invoke Message



Invoke
extends EntityArray<InvokeParameter>
-listener: string
+constructor(string)
+constructor(string, ...args[]: any)
#createChild(XML) -> InvokeParameter
+getArguments() -> any[]
+apply(IProtocol) -> boolean
+TAG() -> string = "invoke"
1
1
0
N
InvokeParameter
extends Entity
#name: string
#type: string
#value: any
+constructor(name: strng, value: any)
+constructor(string, string, any)
+construct(XML)
+TAG() -> string = "parameter"
+toXML() -> XML

Invoke is

Designed to standardize message structure to be used in network communication. By the standardization of message protocol, user does not need to consider about the network handling. Only concentrate on system's own domain functions are required.

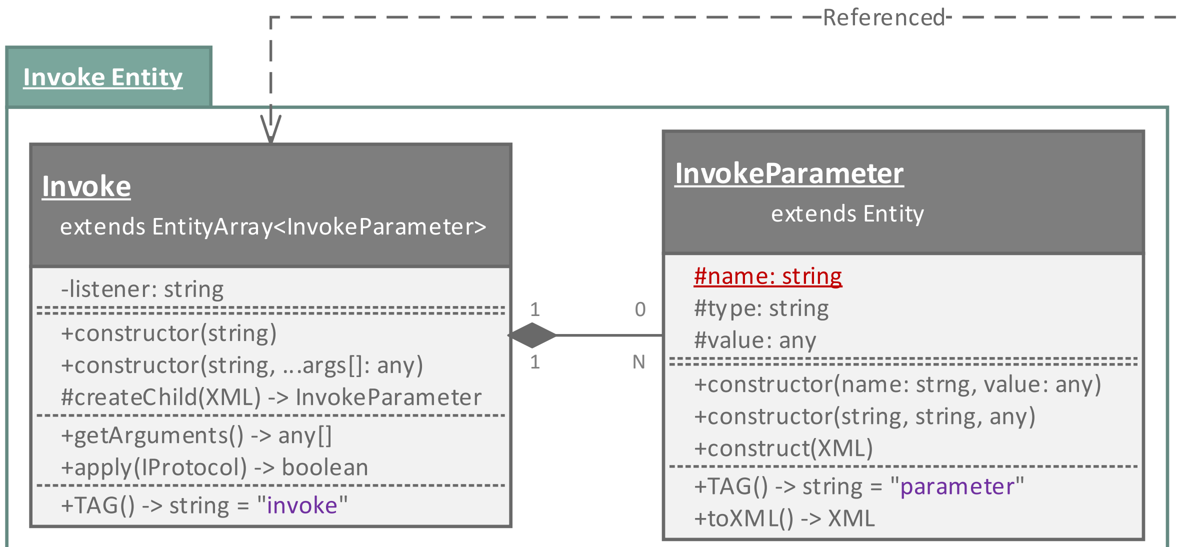
At next page, "Protocol - Interface", you can find "Basic Components" required on building some network system; **IProtocol**, **Server, ClientDriver** and **ServerConnector**. You can construct any type of network system, even how the system is enormously complicated, by just implementing and combinating those "Basic Components".

Secret of we can build any network system by only those basic components lies in the standardization of message protocol, **Invoke**

Message structure of Invoke

```
<?xml version="1.0" encoding="utf-8" ?>
<invoke listener="login">
        <parameter type="string">jhnam88</parameter>
        <parameter type="string">1234</parameter>
        <parameter type="number">4</parameter>
        <parameter type="XML">
                <memberList>
                        <member id="guest" authority="1" />
                        <member id="john" authority="3" />
                        <member id="samchon" authority="5" />
                </memberList>
        </parameter>
</invoke>
```

Invoke Entity



Referenced

Invoke
extends EntityArray<InvokeParameter>

-listener: string

+constructor(string)
+constructor(string, ...args[]: any)
#createChild(XML) -> InvokeParameter

+getArguments() -> any[]
+apply(IProtocol) -> boolean

+TAG() -> string = "invoke"

InvokeParameter
extends Entity

#name: string
#type: string
#value: any

+constructor(name: strng, value: any)
+constructor(string, string, any)
+construct(XML)

+TAG() -> string = "parameter"
+toXML() -> XML

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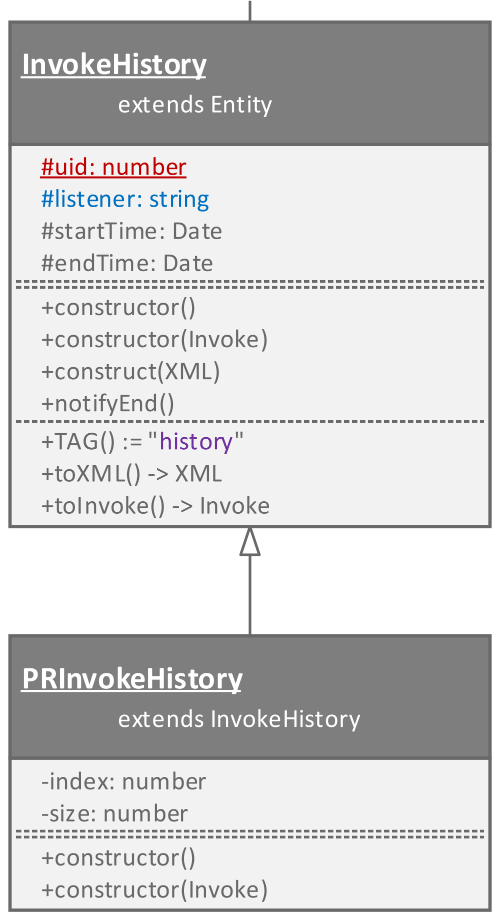
			<member id="samchon" authority="5" />
		</memberList>
	</parameter>
</invoke>
```

Histories



InvokeHistory
extends Entity

#uid: number
#listener: string
#startTime: Date
#endTime: Date

+constructor()
+constructor(Invoke)
+construct(XML)
+notifyEnd()

+TAG() := "history"
+toXML() -> XML
+toInvoke() -> Invoke

PRInvokeHistory
extends InvokeHistory

-index: number
-size: number

+constructor()
+constructor(Invoke)

InvokeHistory is

Designed to report a history log of an Invoke message with elapsed time consumed for handling the Invoke message. The report is directed by a mster from its slaves.

The reported elapsed time is used to estimating performance of a slave system.

PRInvokeHistory

A reported InvokeHistory in framework of a master of parallel processing system. The master of a parallel processing system estimates performance index of a slave system by those reports.

Master distributes quantity of handing process of slave systems from the estimated performance index which is calculated from those reports.

Entity Module

Entity is

To standardize expression method of data structure.

Provides I/O interfaces to/from XML object.

When you need some additional function for the Entity, use the chain responsibility pattern like IEntityChain.

When data-set has a "Hierarchical Relationship"

Compose the data class(entity) having children by inheriting IEntityGroup or IEntityCollection, and terminate the leaf node by inheriting Entity.

Just define the XML I/O only for each variables, then about the data I/O, all will be done

Pre-defined Entity classes

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Entity

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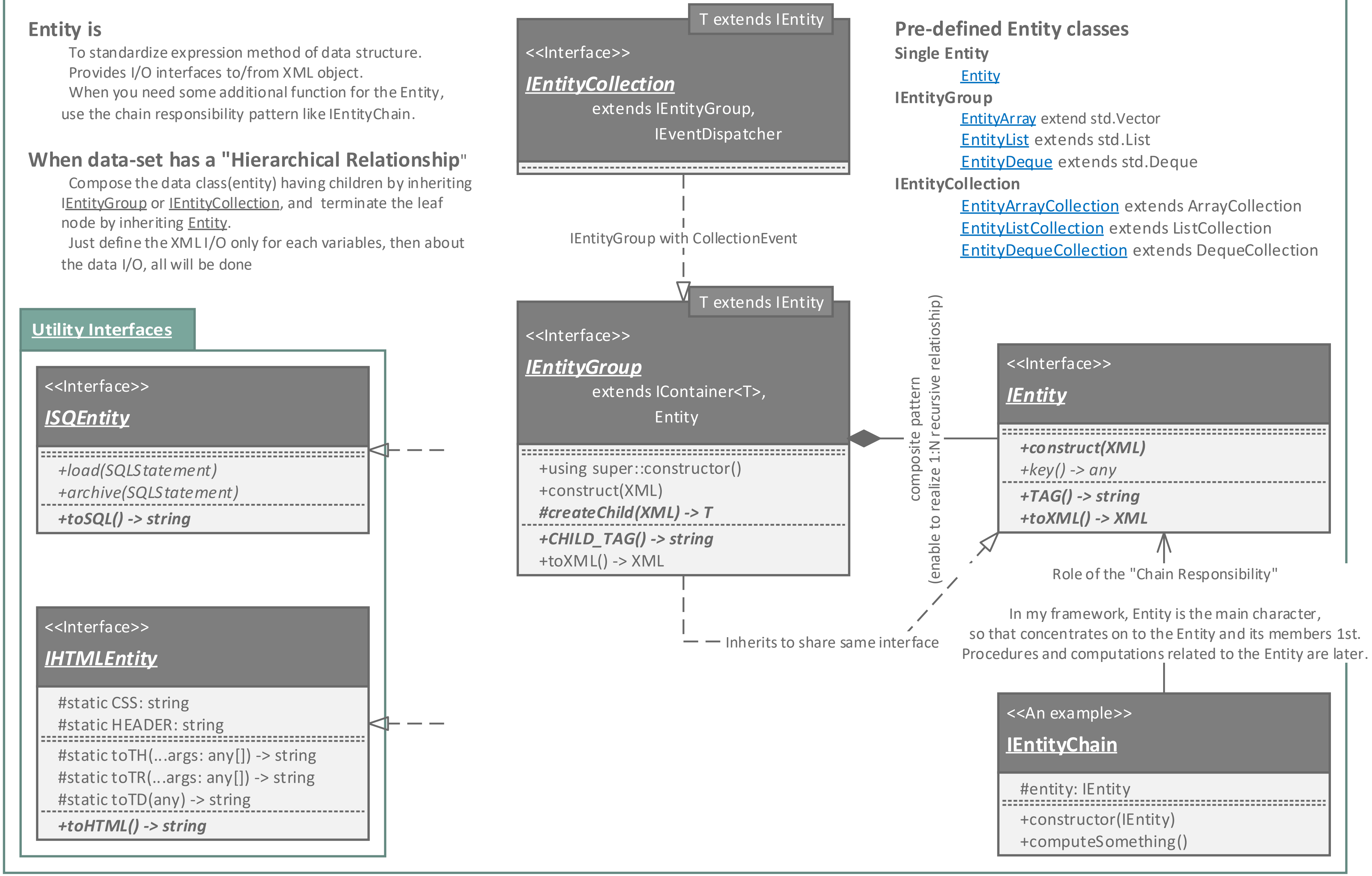


T extends IEntity

<<Interface>>
IEntityCollection
extends IEntityGroup,
IEventDispatcher

IEntityGroup with CollectionEvent

T extends IEntity

<<Interface>>
IEntityGroup
extends IContainer<T>,
Entity

+using super::constructor()
+construct(XML)
#createChild(XML) -> T

+CHILD_TAG() -> string
+toXML() -> XML

composite pattern
(enable to realize 1:N recursive relatioship)

<<Interface>>
IEntity

+construct(XML)
+key() -> any

+TAG() -> string
+toXML() -> XML

Inherits to share same interface

Role of the "Chain Responsibility"

In my framework, Entity is the main character,
so that concentrates on to the Entity and its members 1st.
Procedures and computations related to the Entity are later.

<<An example>>
IEntityChain

#entity: IEntity

+constructor(IEntity)
+computeSomething()

Utility Interfaces

<<Interface>>
ISQEntity

+load(SQLStatement)
+archive(SQLStatement)

+toSQL() -> string

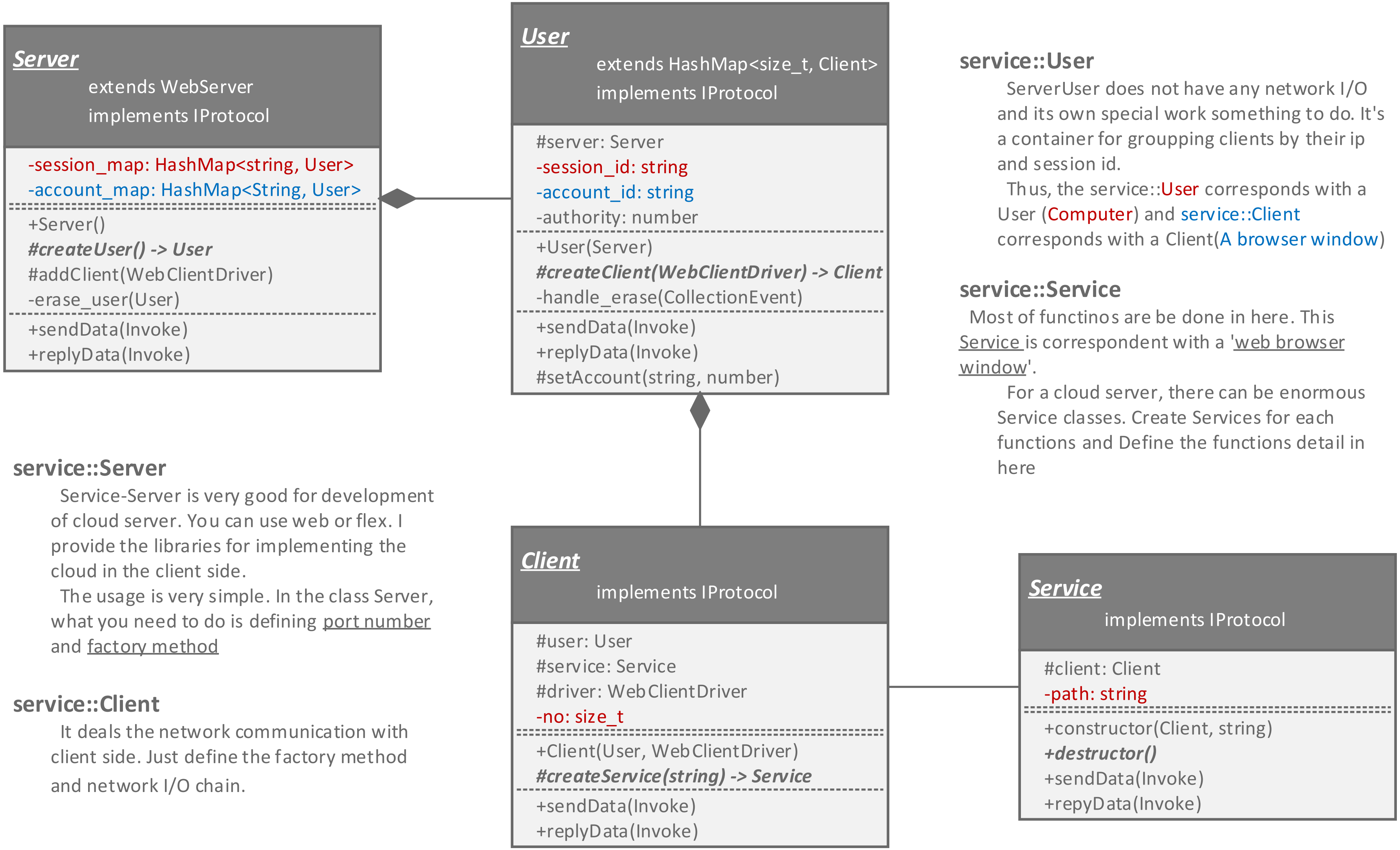
<<Interface>>
IHTMLEntity

#static CSS: string
#static HEADER: string

#static toTH(...args: any[]) -> string
#static toTR(...args: any[]) -> string
#static toTD(any) -> string

+toHTML() -> string

Service



Server
extends WebServer
implements IProtocol

-session_map: HashMap<string, User>
-account_map: HashMap<String, User>

+Server()
#createUser() -> User
#addClient(WebClientDriver)
-erase_user(User)

+sendData(Invoke)
+replyData(Invoke)

User
extends HashMap<size_t, Client>
implements IProtocol

#server: Server
-session_id: string
-account_id: string
-authority: number

+User(Server)
#createClient(WebClientDriver) -> Client
-handle_erase(CollectionEvent)

+sendData(Invoke)
+replyData(Invoke)
#setAccount(string, number)

Client
implements IProtocol

#user: User
#service: Service
#driver: WebClientDriver
-no: size_t

+Client(User, WebClientDriver)
#createService(string) -> Service

+sendData(Invoke)
+replyData(Invoke)

Service
implements IProtocol

#client: Client
-path: string

+constructor(Client, string)
+destructor()
+sendData(Invoke)
+repyData(Invoke)

service::User

ServerUser does not have any network I/O and its own special work something to do. It's a container for groupping clients by their ip and session id.

Thus, the service::User corresponds with a User (Computer) and service::Client corresponds with a Client(A browser window)

## service::Service

Most of functinos are be done in here. This Service is correspondent with a 'web browser window'.

For a cloud server, there can be enormous Service classes. Create Services for each functions and Define the functions detail in here

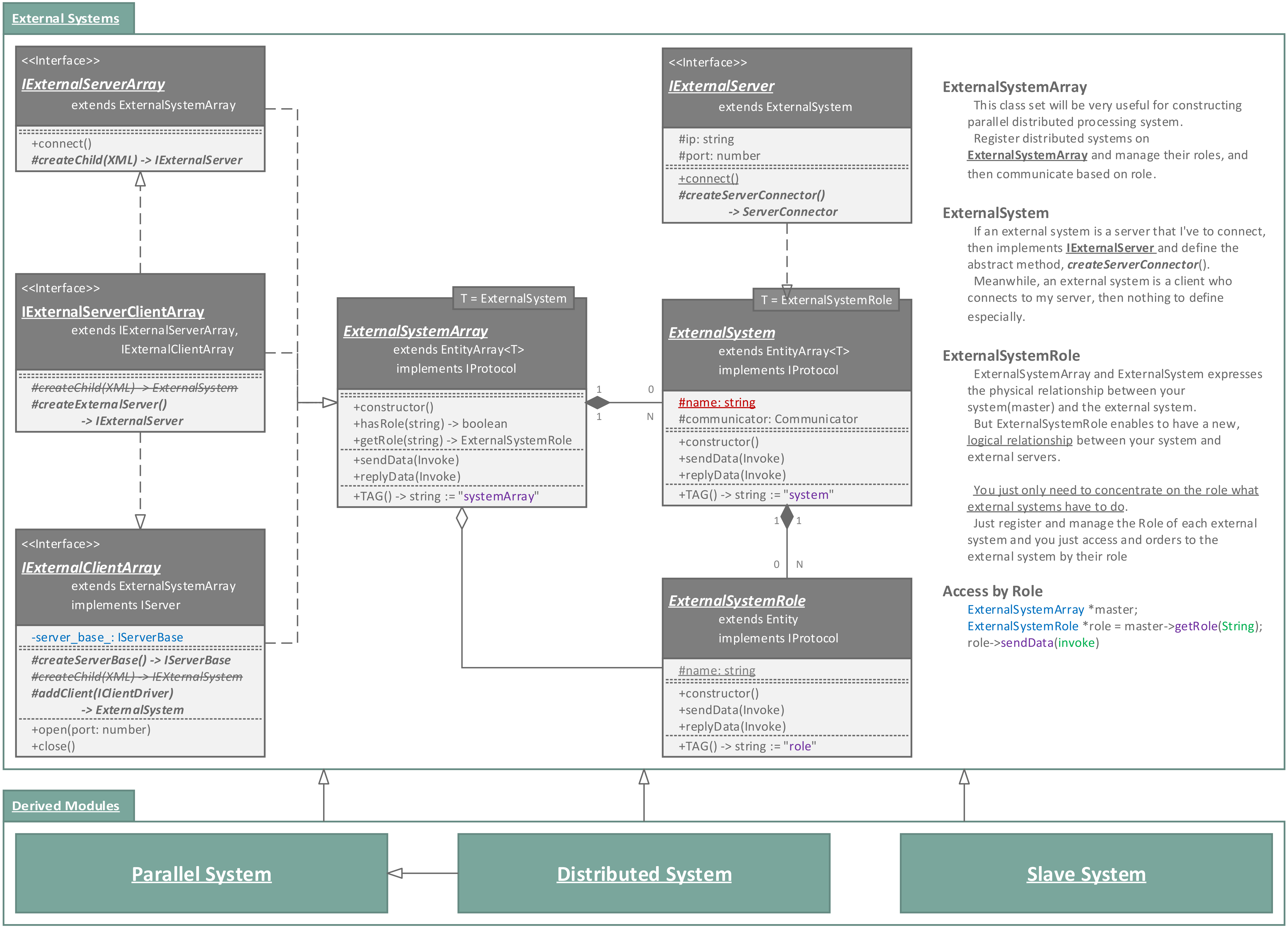
service::Server

Service-Server is very good for development of cloud server. You can use web or flex. I provide the libraries for implementing the cloud in the client side.

The usage is very simple. In the class Server, what you need to do is defining port number and factory method

service::Client

It deals the network communication with client side. Just define the factory method and network I/O chain.



External Systems

<<Interface>>
IExternalServerArray
extends ExternalSystemArray
+connect()
#createChild(XML) -> IExternalServer

<<Interface>>
IExternalServerClientArray
extends IExternalServerArray,
IExternalClientArray
~~#createChild(XML) -> ExternalSystem~~
#createExternalServer()
-> IExternalServer

<<Interface>>
IExternalClientArray
extends ExternalSystemArray
implements IServer
-server_base_: IServerBase
#createServerBase() -> IServerBase
~~#createChild(XML) -> IExternalSystem~~
#addClient(IClientDriver)
-> ExternalSystem
+open(port: number)
+close()

T = ExternalSystem
ExternalSystemArray
extends EntityArray<T>
implements IProtocol
+constructor()
+hasRole(string) -> boolean
+getRole(string) -> ExternalSystemRole
+sendData(Invoke)
+replyData(Invoke)
+TAG() -> string := "systemArray"

<<Interface>>
IExternalServer
extends ExternalSystem
#ip: string
#port: number
+connect()
#createServerConnector()
-> ServerConnector

T = ExternalSystemRole
ExternalSystem
extends EntityArray<T>
implements IProtocol
#name: string
#communicator: Communicator
+constructor()
+sendData(Invoke)
+replyData(Invoke)
+TAG() -> string := "system"

ExternalSystemRole
extends Entity
implements IProtocol
#name: string
+constructor()
+sendData(Invoke)
+replyData(Invoke)
+TAG() -> string := "role"

Derived Modules

Parallel System

Distributed System

Slave System

ExternalSystemArray

This class set will be very useful for constructing parallel distributed processing system.

Register distributed systems on **ExternalSystemArray** and manage their roles, and then communicate based on role.

ExternalSystem

If an external system is a server that I've to connect, then implements **IExternalServer** and define the abstract method, ***createServerConnector***().

Meanwhile, an external system is a client who connects to my server, then nothing to define especially.

ExternalSystemRole

ExternalSystemArray and ExternalSystem expresses the physical relationship between your system(master) and the external system.

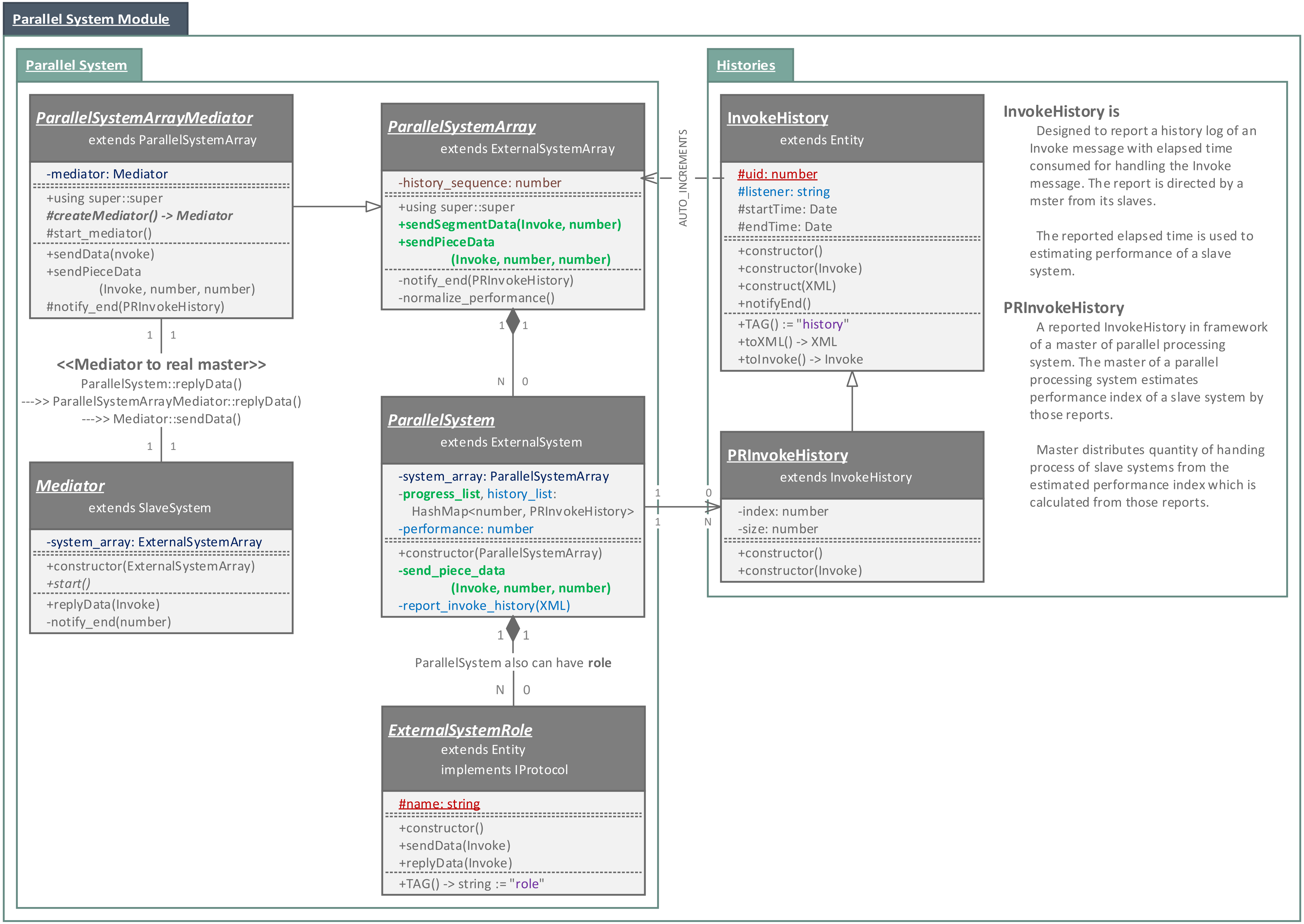
But ExternalSystemRole enables to have a new, logical relationship between your system and external servers.

You just only need to concentrate on the role what external systems have to do.

Just register and manage the Role of each external system and you just access and orders to the external system by their role

Access by Role

```
ExternalSystemArray *master;
ExternalSystemRole *role = master->getRole(String);
role->sendData(invoke)
```



Parallel System Module

Parallel System

ParallelSystemArrayMediator
extends ParallelSystemArray

-mediator: Mediator

+using super::super
#createMediator() -> Mediator
#start_mediator()

+sendData(nvoke)
+sendPieceData
(Invoke, number, number)
#notify_end(PRInvokeHistory)

ParallelSystemArray
extends ExternalSystemArray

-history_sequence: number

+using super::super
+sendSegmentData(Invoke, number)
+sendPieceData
(Invoke, number, number)

-notify_end(PRInvokeHistory)
-normalize_performance()

<<Mediator to real master>>
ParallelSystem::replyData()
--->> ParallelSystemArrayMediator::replyData()
--->> Mediator::sendData()

Mediator
extends SlaveSystem

-system_array: ExternalSystemArray

+constructor(ExternalSystemArray)
+start()

+replyData(Invoke)
-notify_end(number)

ParallelSystem
extends ExternalSystem

-system_array: ParallelSystemArray
-**progress_list**, history_list:
HashMap<number, PRInvokeHistory>
-performance: number

+constructor(ParallelSystemArray)
-send_piece_data
(Invoke, number, number)
-report_invoke_history(XML)

ParallelSystem also can have **role**

ExternalSystemRole
extends Entity
implements IProtocol

#name: string

+constructor()
+sendData(Invoke)
+replyData(Invoke)

+TAG() -> string := "role"

Histories

InvokeHistory
extends Entity

#uid: number
#listener: string
#startTime: Date
#endTime: Date

+constructor()
+constructor(Invoke)
+construct(XML)
+notifyEnd()

+TAG() := "history"
+toXML() -> XML
+toInvoke() -> Invoke

PRInvokeHistory
extends InvokeHistory

-index: number
-size: number

+constructor()
+constructor(Invoke)

InvokeHistory is

Designed to report a history log of an Invoke message with elapsed time consumed for handling the Invoke message. The report is directed by a mster from its slaves.

The reported elapsed time is used to estimating performance of a slave system.

PRInvokeHistory

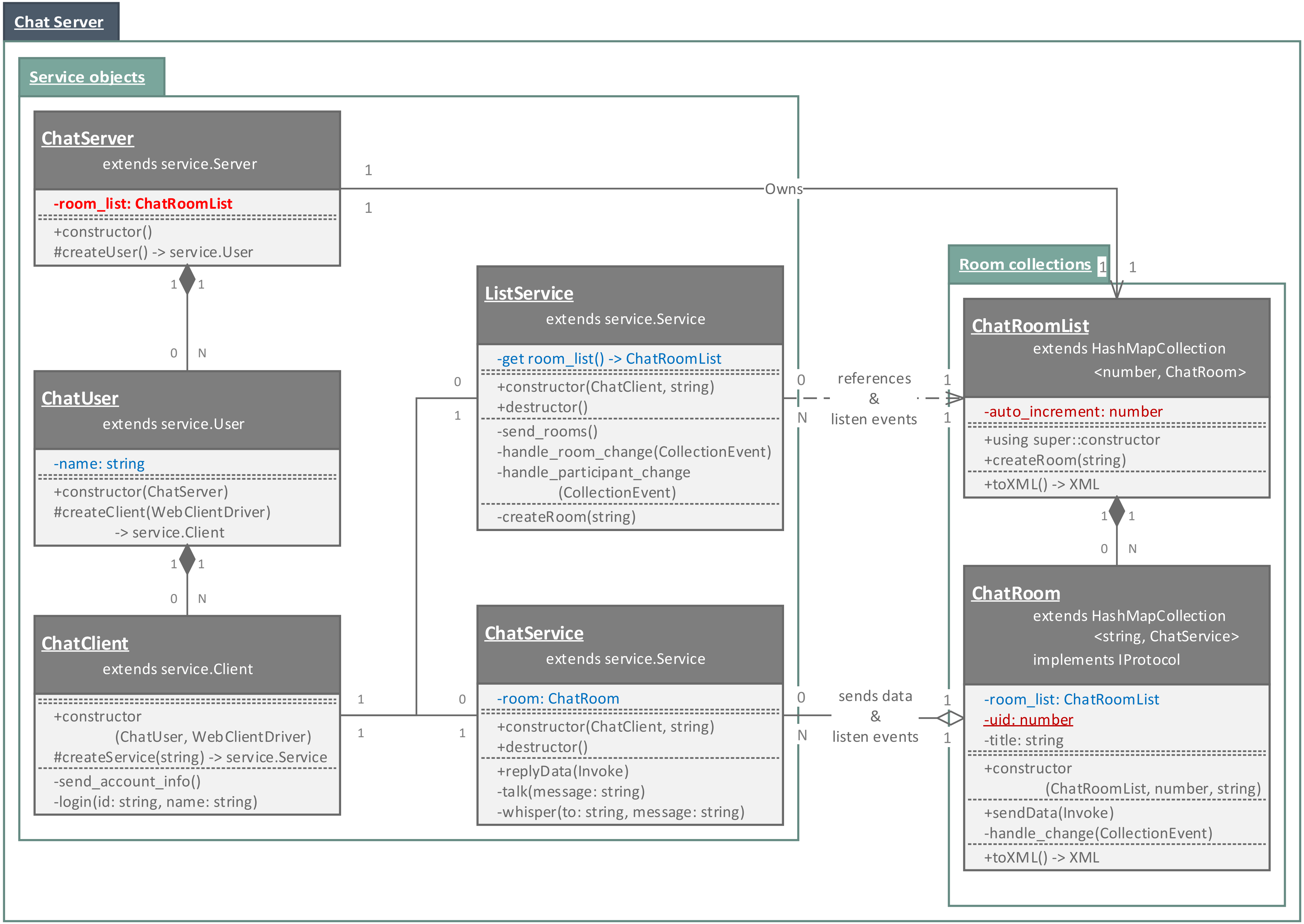
A reported InvokeHistory in framework of a master of parallel processing system. The master of a parallel processing system estimates performance index of a slave system by those reports.

Master distributes quantity of handing process of slave systems from the estimated performance index which is calculated from those reports.

Examples

Guidance Projects

Chat Server & Application Interaction



Chat Server

Service objects

ChatServer
extends service.Server
-room_list: ChatRoomList
+constructor()
#createUser() -> service.User

ChatUser
extends service.User
-name: string
+constructor(ChatServer)
#createClient(WebClientDriver)
-> service.Client

ChatClient
extends service.Client
+constructor
(ChatUser, WebClientDriver)
#createService(string) -> service.Service
-send_account_info()
-login(id: string, name: string)

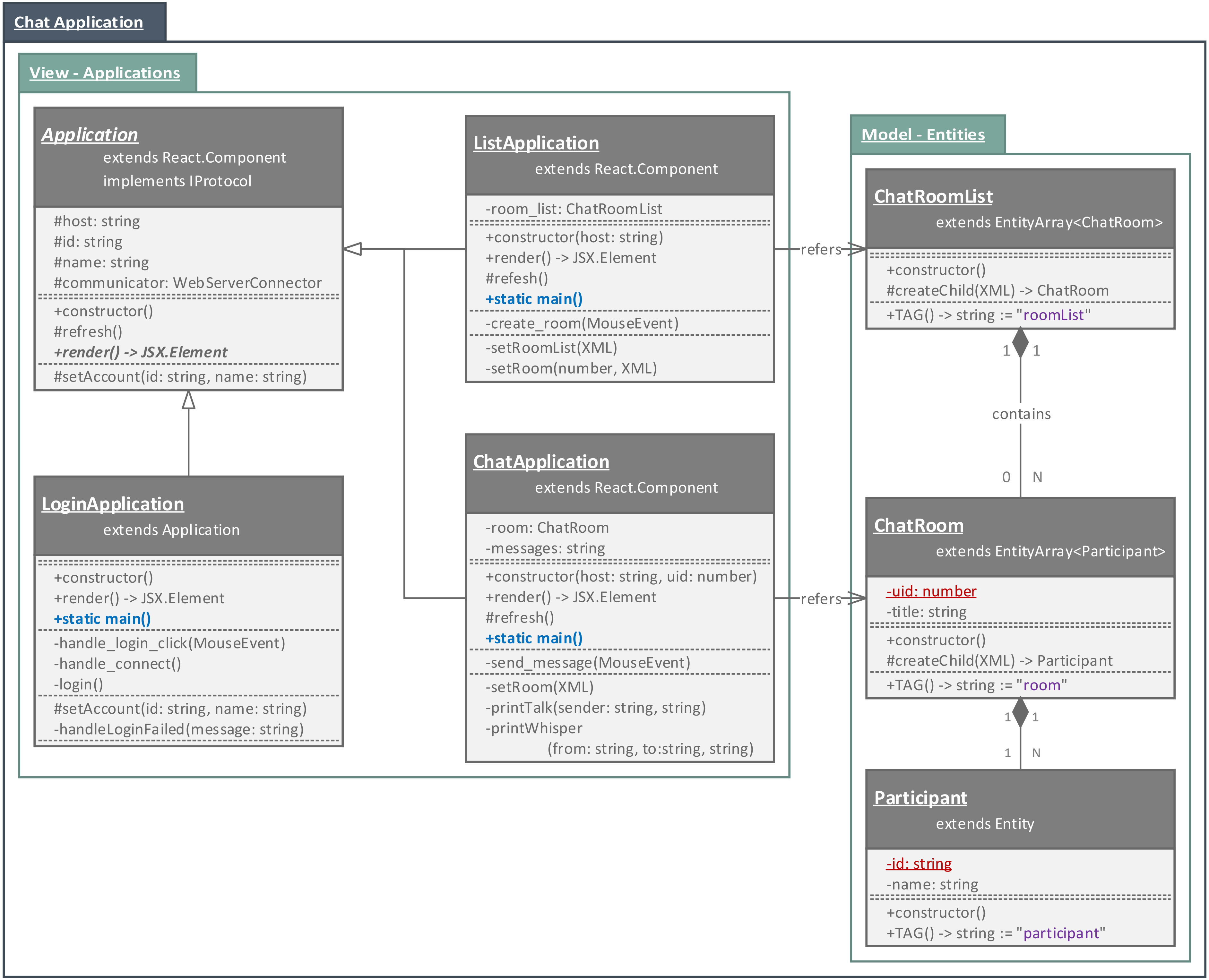
ListService
extends service.Service
-get room_list() -> ChatRoomList
+constructor(ChatClient, string)
+destructor()
-send_rooms()
-handle_room_change(CollectionEvent)
-handle_participant_change
(CollectionEvent)
-createRoom(string)

ChatService
extends service.Service
-room: ChatRoom
+constructor(ChatClient, string)
+destructor()
+replyData(Invoke)
-talk(message: string)
-whisper(to: string, message: string)

Room collections

ChatRoomList
extends HashMapCollection
<number, ChatRoom>
-auto_increment: number
+using super::constructor
+createRoom(string)
+toXML() -> XML

ChatRoom
extends HashMapCollection
<string, ChatService>
implements IProtocol
-room_list: ChatRoomList
-uid: number
-title: string
+constructor
(ChatRoomList, number, string)
+sendData(Invoke)
-handle_change(CollectionEvent)
+toXML() -> XML



Chat Application

View - Applications

Application
extends React.Component
implements IProtocol

#host: string
#id: string
#name: string
#communicator: WebServerConnector

+constructor()
#refresh()
+render() -> JSX.Element

#setAccount(id: string, name: string)

ListApplication
extends React.Component

-room_list: ChatRoomList

+constructor(host: string)
+render() -> JSX.Element
#refesh()
+static main()

-create_room(MouseEvent)

-setRoomList(XML)
-setRoom(number, XML)

LoginApplication
extends Application

+constructor()
+render() -> JSX.Element
+static main()

-handle_login_click(MouseEvent)
-handle_connect()
-login()

#setAccount(id: string, name: string)
-handleLoginFailed(message: string)

ChatApplication
extends React.Component

-room: ChatRoom
-messages: string

+constructor(host: string, uid: number)
+render() -> JSX.Element
#refresh()
+static main()

-send_message(MouseEvent)

-setRoom(XML)
-printTalk(sender: string, string)
-printWhisper
(from: string, to:string, string)

Model - Entities

ChatRoomList
extends EntityArray<ChatRoom>

+constructor()
#createChild(XML) -> ChatRoom

+TAG() -> string := "roomList"

ChatRoom
extends EntityArray<Participant>

-uid: number
-title: string

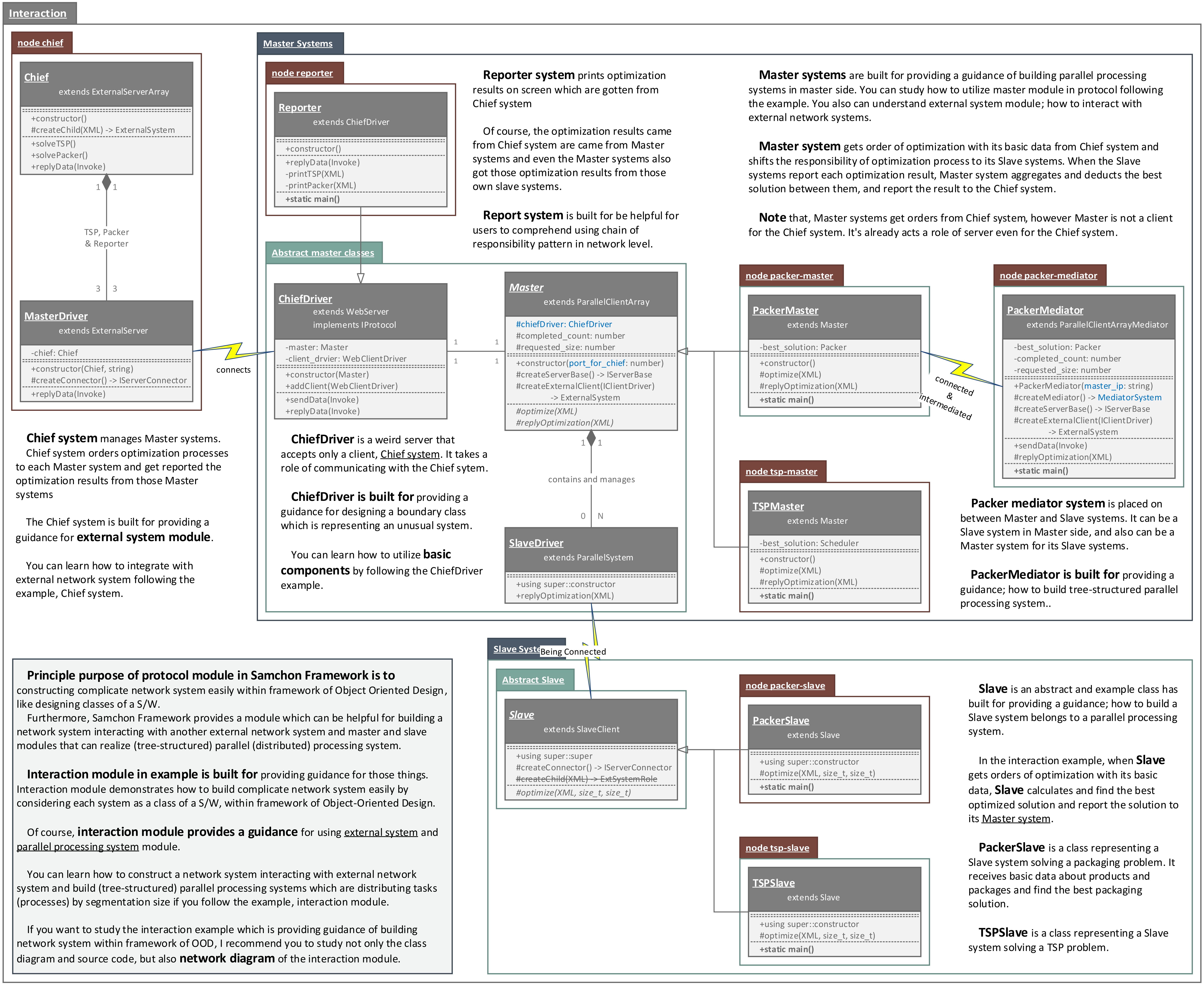
+constructor()
#createChild(XML) -> Participant

+TAG() -> string := "room"

Participant
extends Entity

-id: string
-name: string

+constructor()
+TAG() -> string := "participant"



Chief system manages Master systems. Chief system orders optimization processes to each Master system and get reported the optimization results from those Master systems

The Chief system is built for providing a guidance for **external system module**.

You can learn how to integrate with external network system following the example, Chief system.

Reporter system prints optimization results on screen which are gotten from Chief system

Of course, the optimization results came from Chief system are came from Master systems and even the Master systems also got those optimization results from those own slave systems.

Report system is built for be helpful for users to comprehend using chain of responsibility pattern in network level.

Master systems are built for providing a guidance of building parallel processing systems in master side. You can study how to utilize master module in protocol following the example. You also can understand external system module; how to interact with external network systems.

Master system gets order of optimization with its basic data from Chief system and shifts the responsibility of optimization process to its Slave systems. When the Slave systems report each optimization result, Master system aggregates and deducts the best solution between them, and report the result to the Chief system.

Note that, Master systems get orders from Chief system, however Master is not a client for the Chief system. It's already acts a role of server even for the Chief system.

ChiefDriver is a weird server that accepts only a client, Chief system. It takes a role of communicating with the Chief sytem.

ChiefDriver is built for providing a guidance for designing a boundary class which is representing an unusual system.

You can learn how to utilize **basic components** by following the ChiefDriver example.

Packer mediator system is placed on between Master and Slave systems. It can be a Slave system in Master side, and also can be a Master system for its Slave systems.

PackerMediator is built for providing a guidance; how to build tree-structured parallel processing system..

Principle purpose of protocol module in Samchon Framework is to constructing complicate network system easily within framework of Object Oriented Design, like designing classes of a S/W.
Furthermore, Samchon Framework provides a module which can be helpful for building a network system interacting with another external network system and master and slave modules that can realize (tree-structured) parallel (distributed) processing system.

Interaction module in example is built for providing guidance for those things. Interaction module demonstrates how to build complicate network system easily by considering each system as a class of a S/W, within framework of Object-Oriented Design.

Of course, **interaction module provides a guidance** for using external system and parallel processing system module.

You can learn how to construct a network system interacting with external network system and build (tree-structured) parallel processing systems which are distributing tasks (processes) by segmentation size if you follow the example, interaction module.

If you want to study the interaction example which is providing guidance of building network system within framework of OOD, I recommend you to study not only the class diagram and source code, but also **network diagram** of the interaction module.

Slave is an abstract and example class has built for providing a guidance; how to build a Slave system belongs to a parallel processing system.

In the interaction example, when **Slave** gets orders of optimization with its basic data, **Slave** calculates and find the best optimized solution and report the solution to its Master system.

PackerSlave is a class representing a Slave system solving a packaging problem. It receives basic data about products and packages and find the best packaging solution.

TSPSlave is a class representing a Slave system solving a TSP problem.