

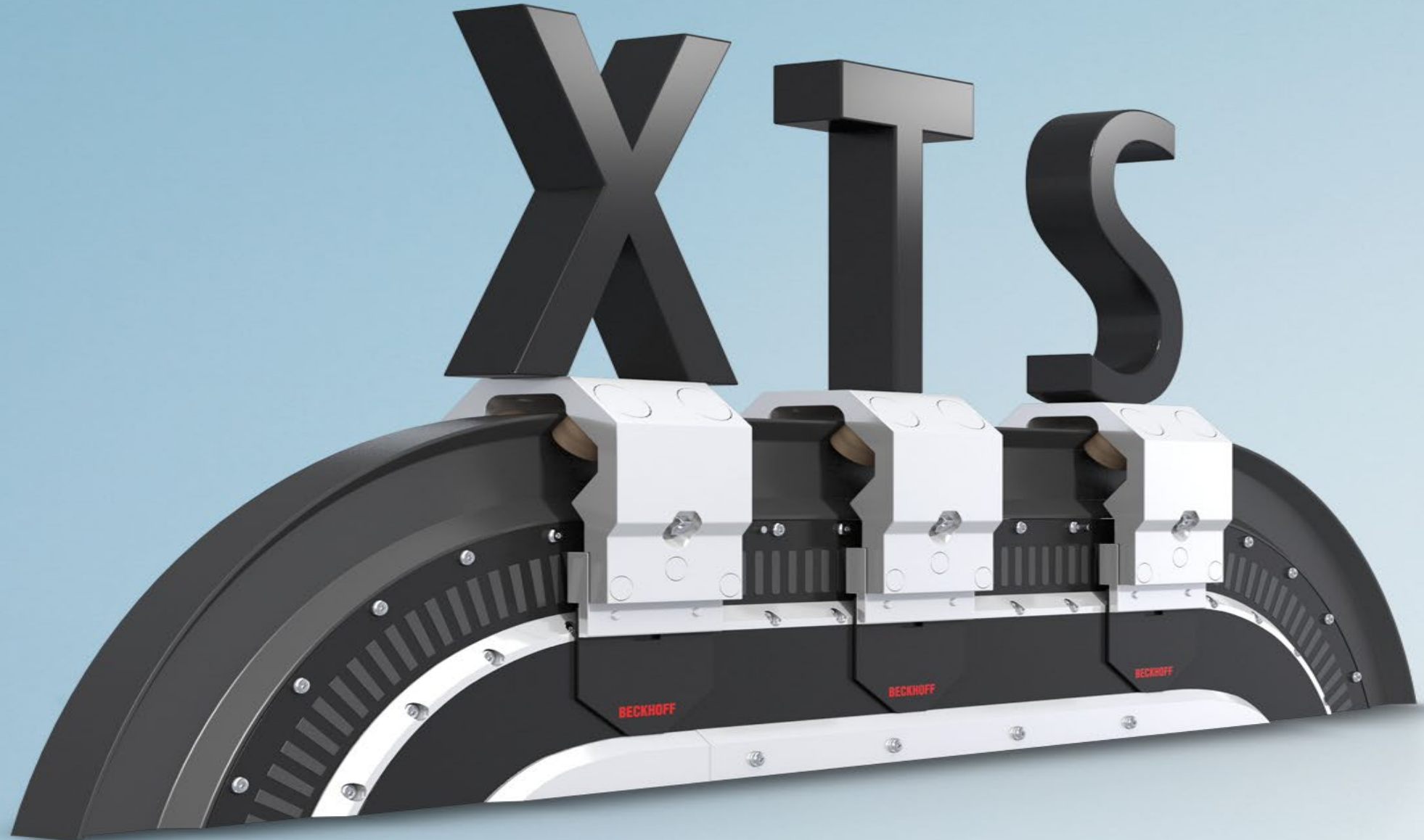
New Automation Technology

Beckhoff Automation

Beckhoff-Training | TR3056 : Q3/2024

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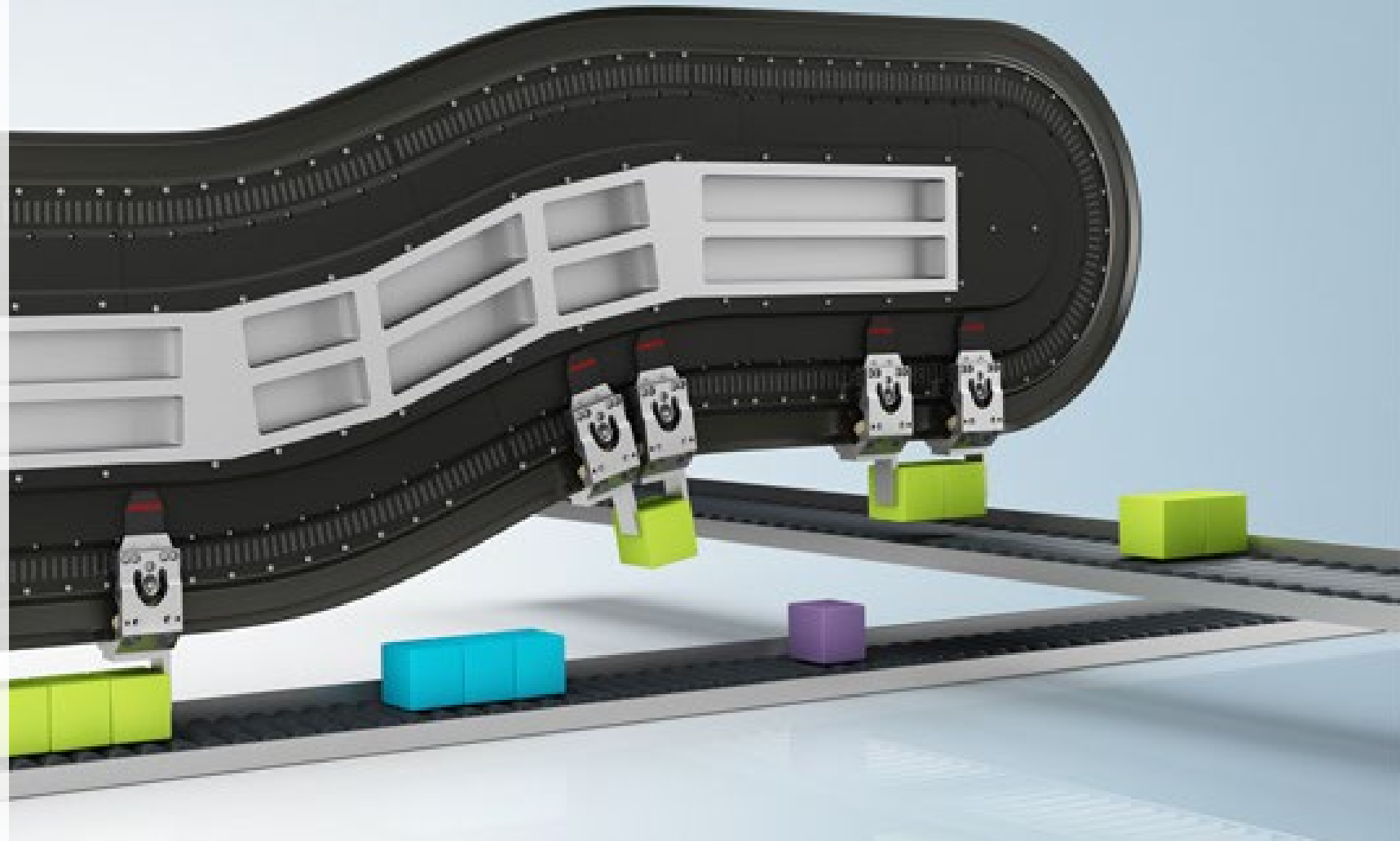


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XTS – PLC Software Concept

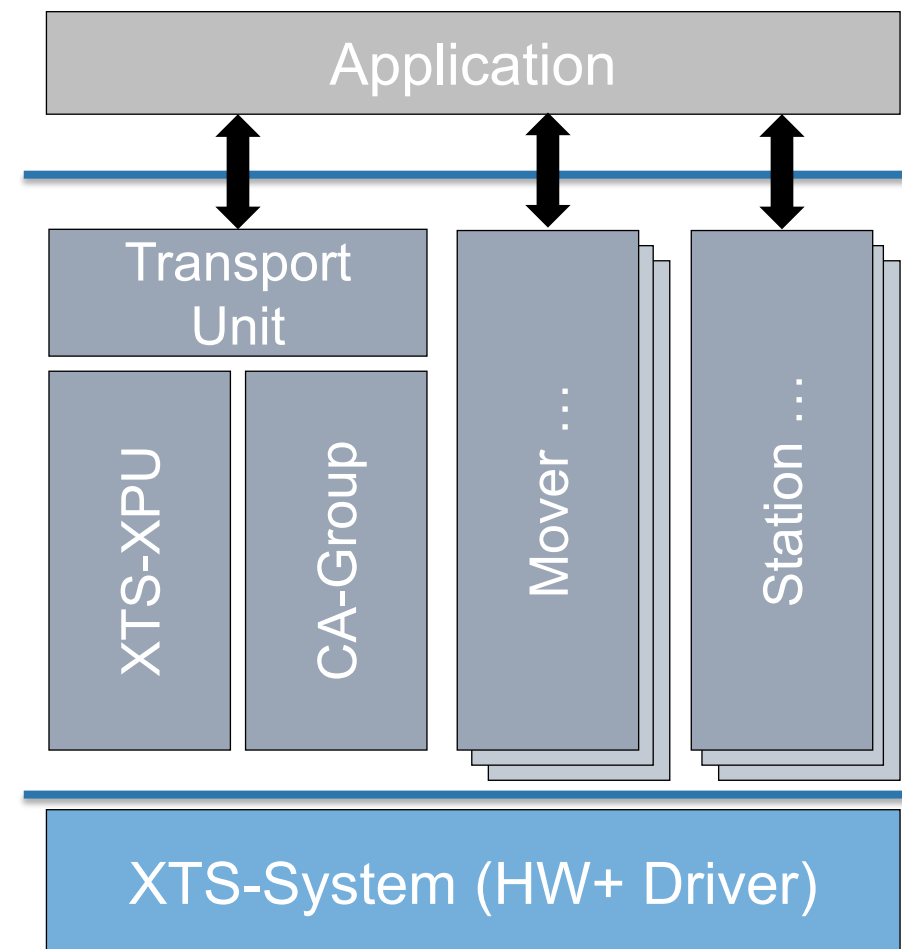


1. **PLC Software concept**
2. Station concept
3. XTS XPU Object
4. CA-Group Object
5. Mover Object
6. Station Object
7. Transport Unit



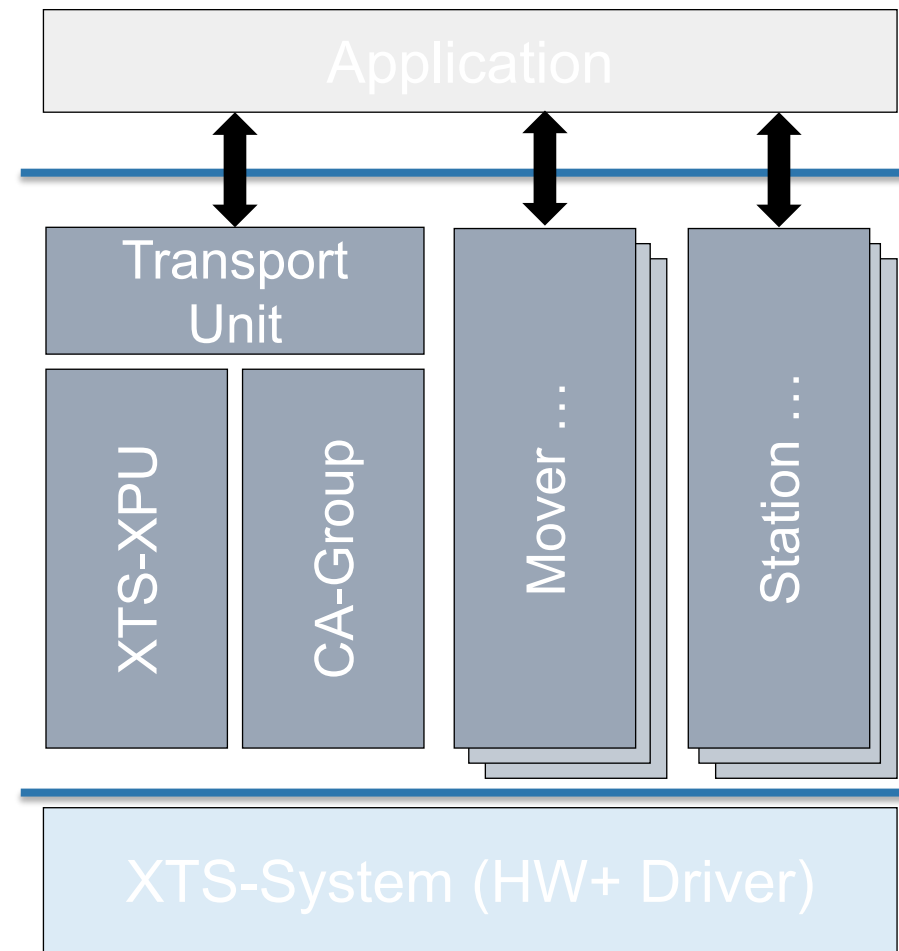
General Idee:

- The entire application is divided into a transport layer and an application layer
- The communication between the transport layer and the application layer is handled via a “Transport Unit”, “Mover” and “Stations”.
- The application can be Part of the XTS-System or of a separate control-system



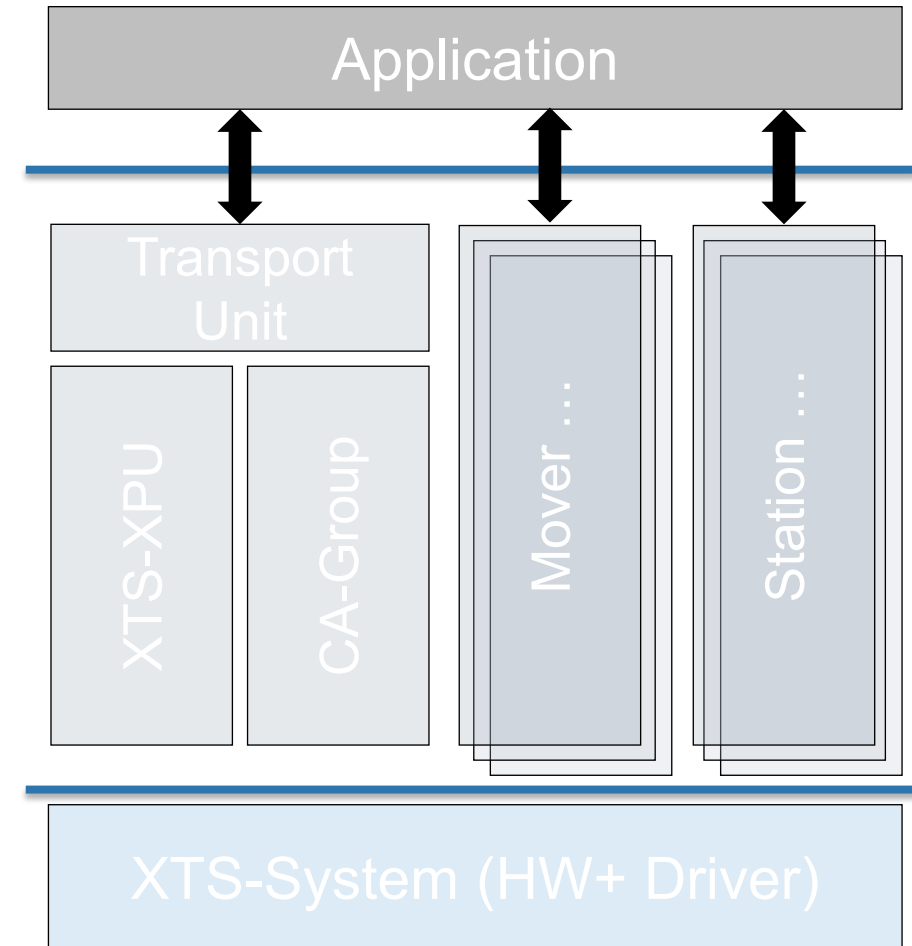
Idee transport layer :

- Communication with the XPU-Driver and the hardware is handled via a separate Class
- The handling of the CA Group is carried out in the transport layer, also as a separate Class
- The XTS movers are linked to the motion control via a mover object (class)
- The Transport Unit sends the commands via station objects to the corresponding mover objects.



Idee application layer :

- represents the connection between the XTS system and the individual processing stations of the machine.
- triggers the general sequence for transport handling
- triggers the handling for the transport stations
- communication can be done directly or via interfaces

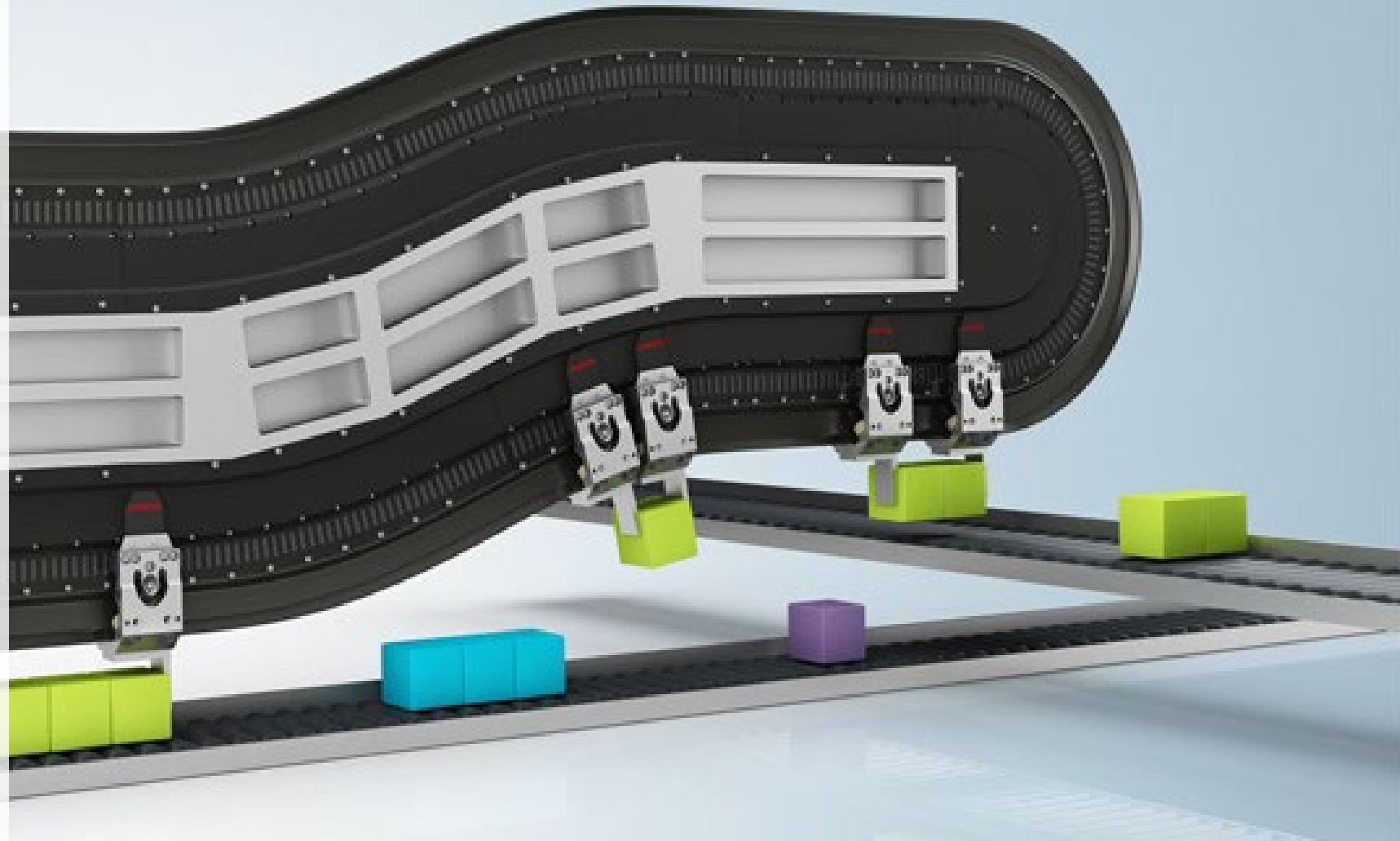


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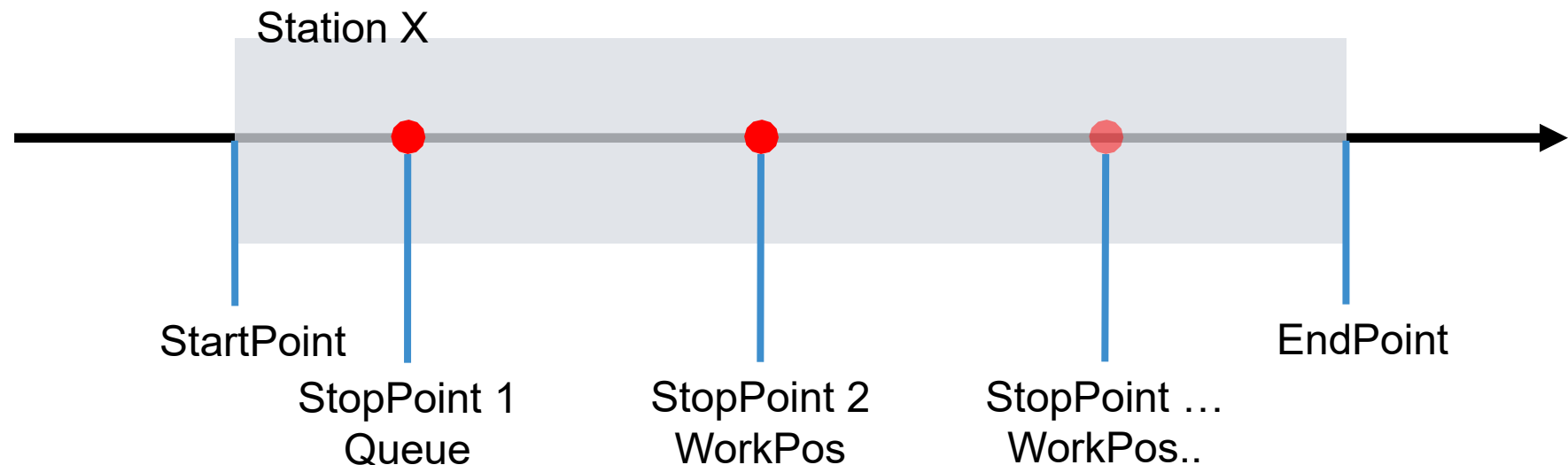
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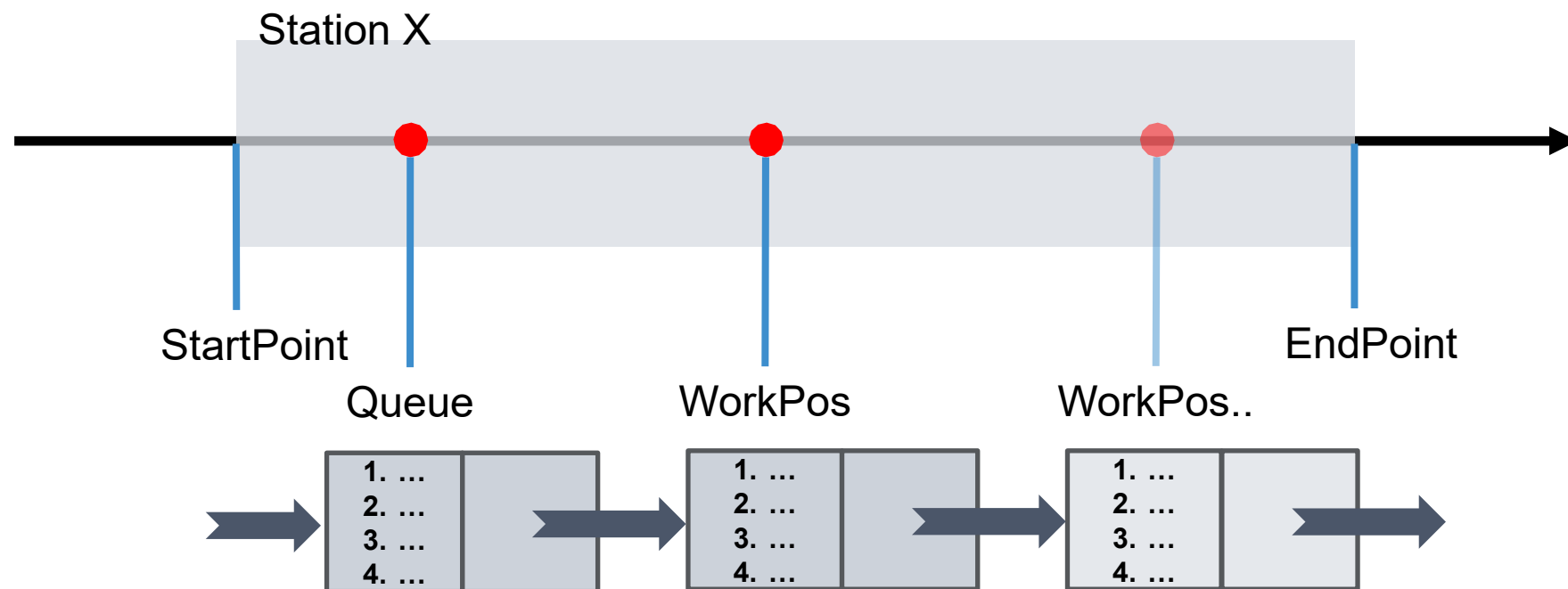
Idee Station:

- A station describes a production area on the transport segment
- The station has a start and end point
- The station can contain several stop points that can be used as queue and processing positions



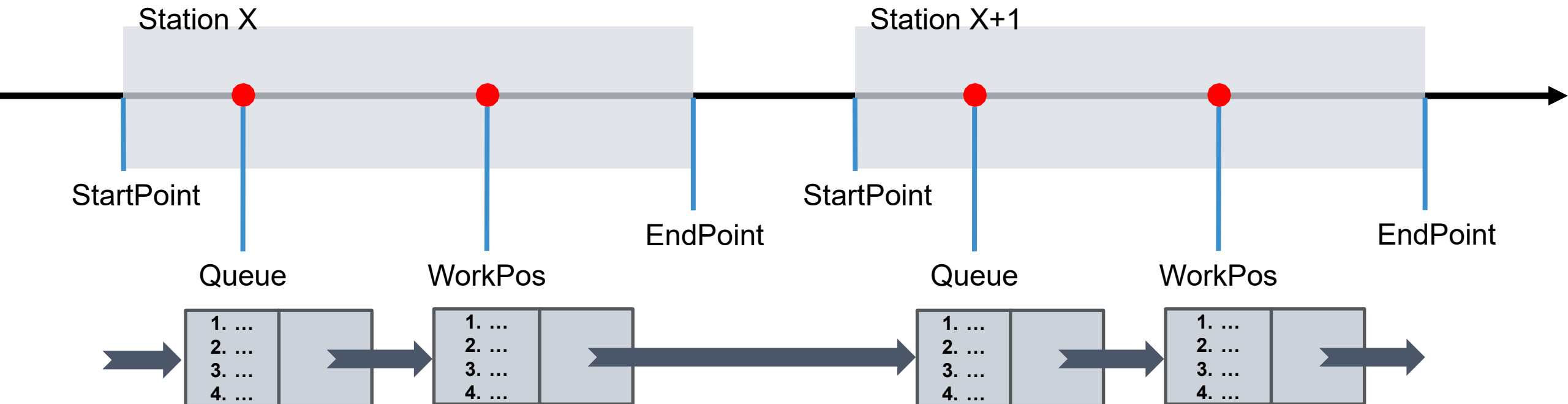
Idee Station:

- A list with the mover IDs is handled for each stop position
- The lists are linked together (linked list)



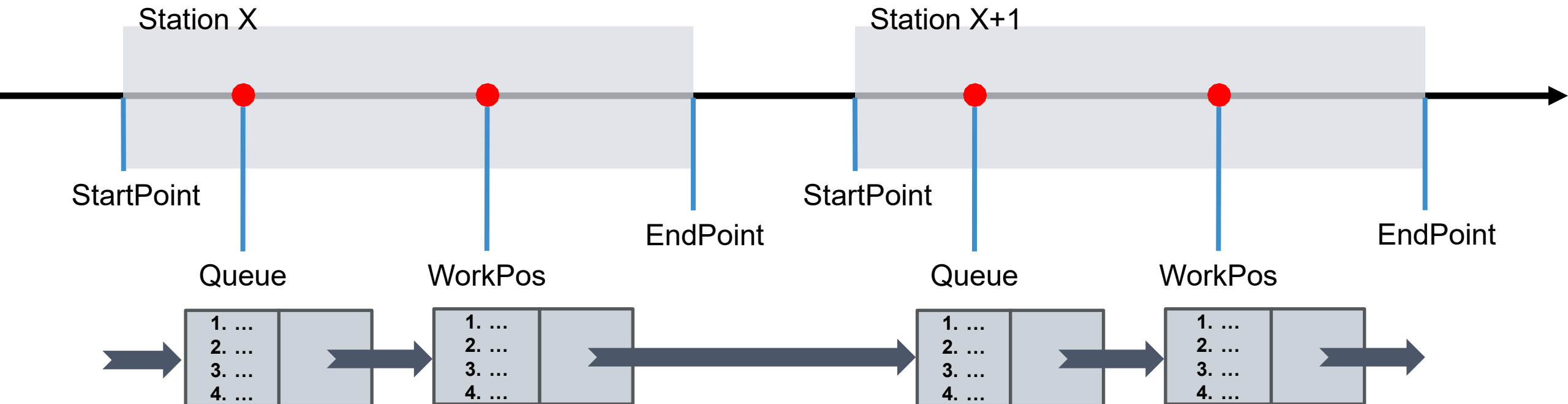
Idee Station:

- Stations are used like linked list



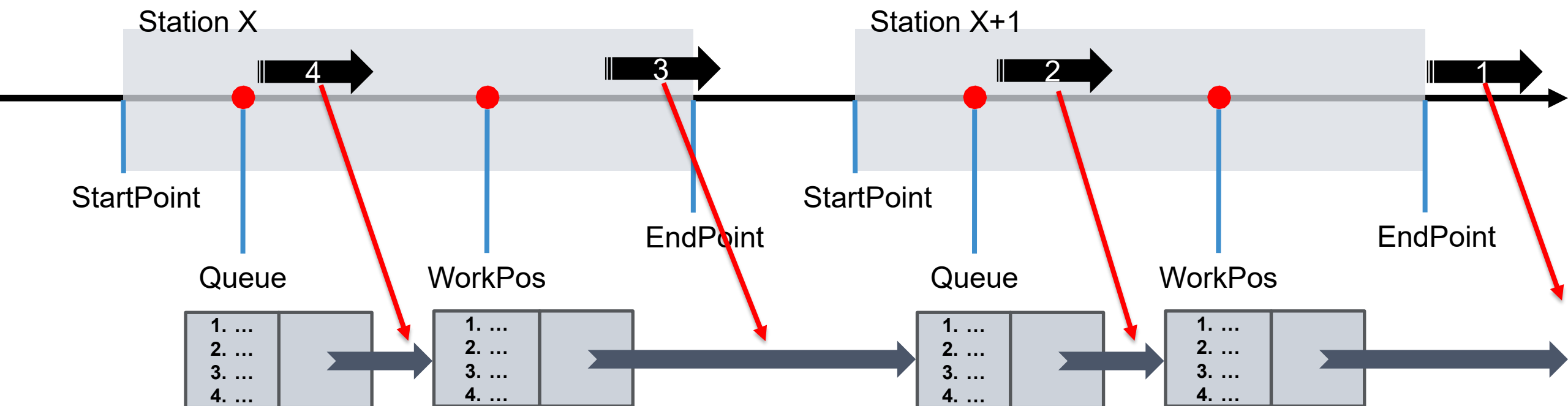
Idee Station:

- Various working concepts are possible
 1. Send Mover from position to position (forward command flow)
 2. Requesting the mover from the pre-station (reverse command flow)



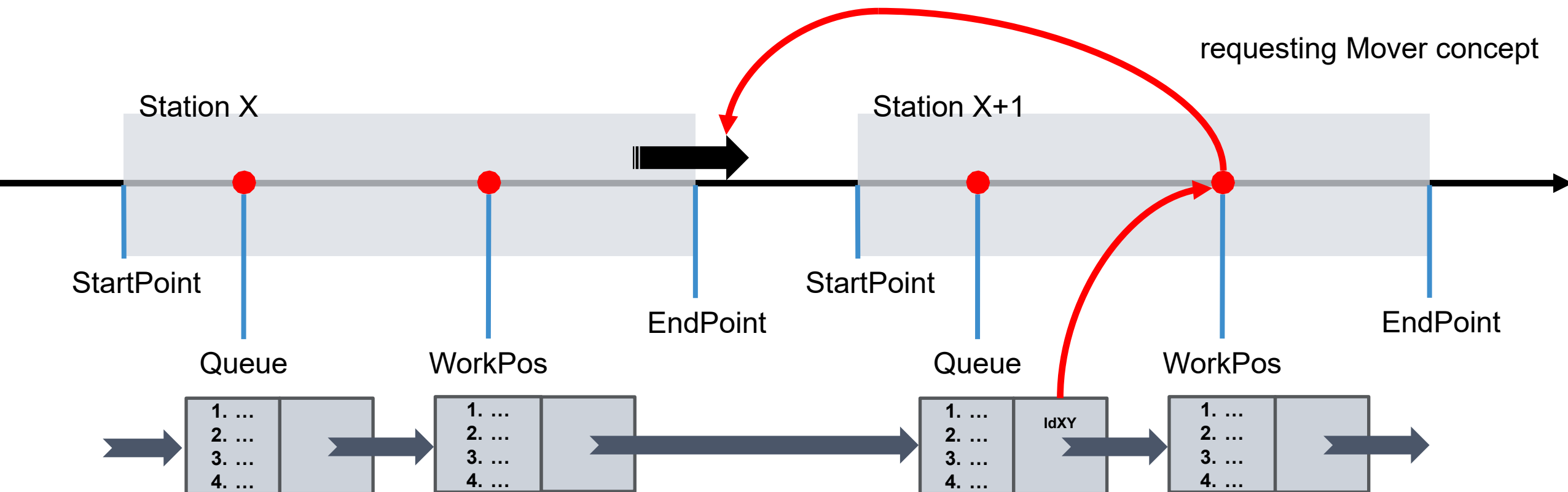
Idee Station:

- From a stop position, the mover is moving to the next position when the next position is released
- During the driving command, the list entry is also transferred to the following list (depending on the actual position)



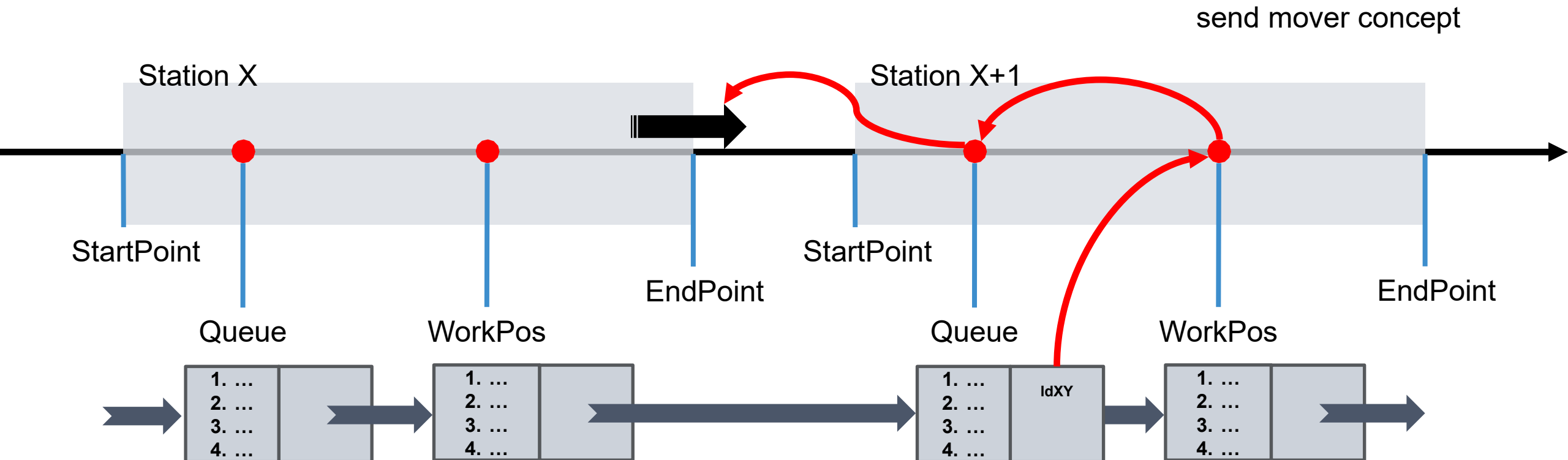
Idee Station:

- The processing position can access movers that are entered in the queue position and request a new move command (flying infeed)



Idee Station:

- The processing position can access movers that are entered in the queue position and request a new move command (flying infeed)

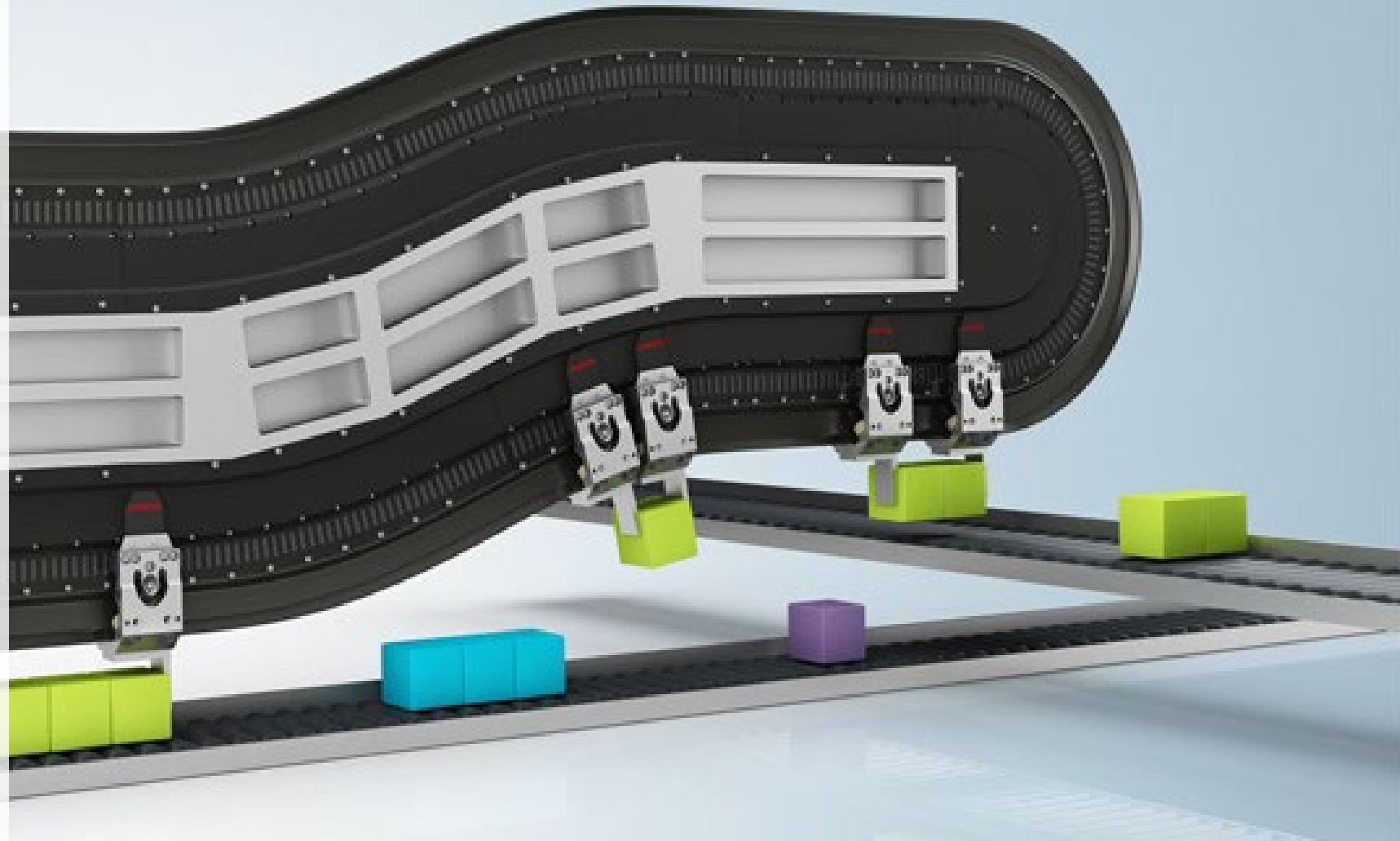


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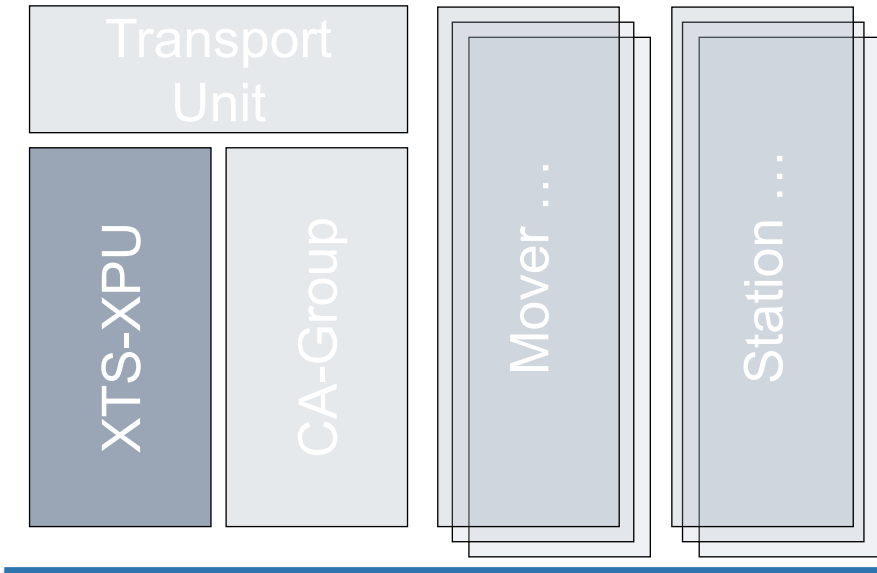
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1. PLC Software concept
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XPU Object

- The XPU Object handle communication with the XTS Driver and Supplement's
 - XPU
 - Part's
 - Module
 - Mover / Mover Parameter
 - Mover Id identification
 - Station_Info
 - Station



XPU Object

- The XPU Object handle these methods

METHOD Cycle

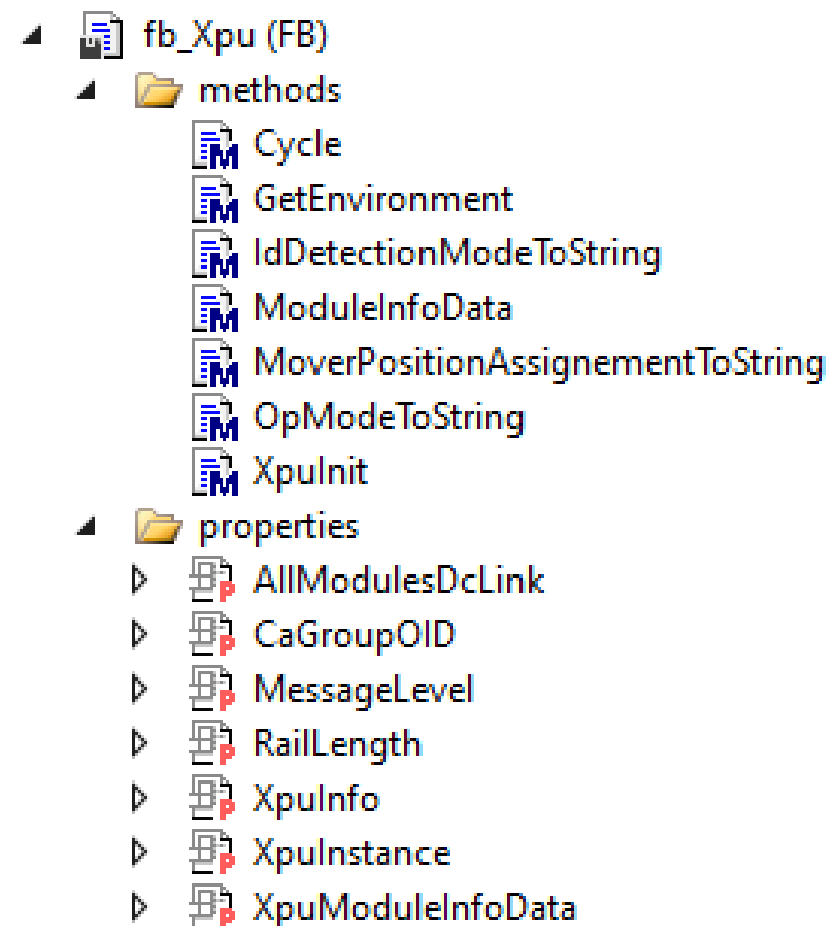
METHOD XpuInit

METHOD IdDetectionModeToString

METHOD ModuleInfoData

METHOD MoverPositionAssigementToString

METHOD OpModeToString



XPU Object

- The XPU Object handle these properties

PROPERTY Init : REFERENCE to E_XPU_INIT

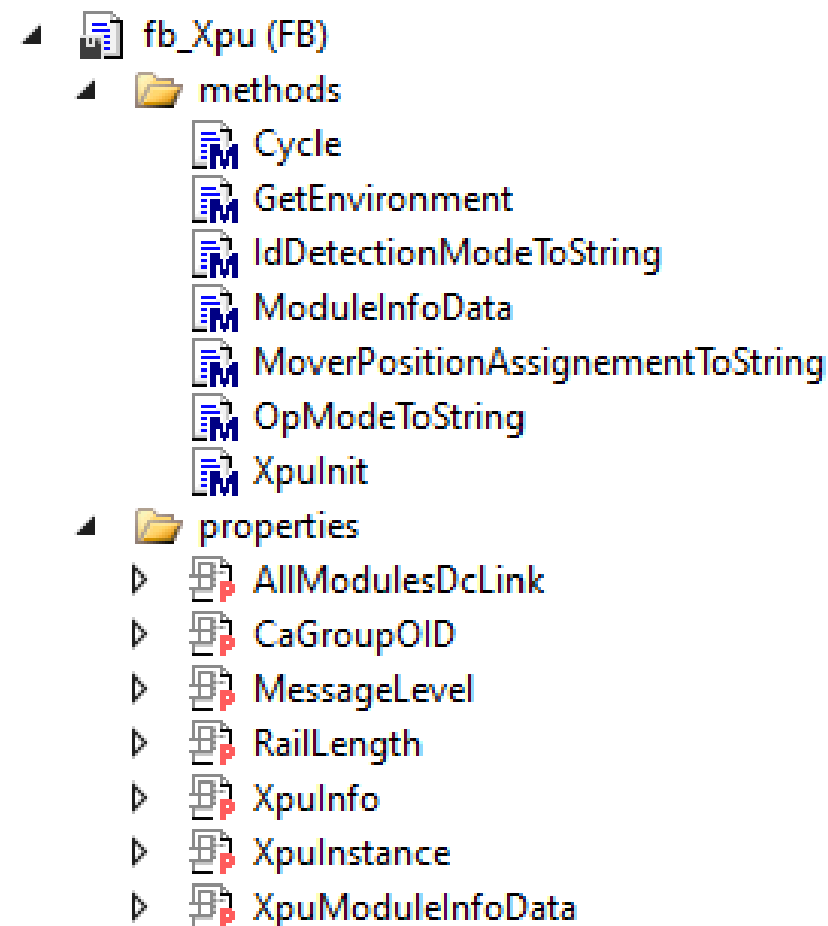
PROPERTY XpuInfo : REFERENCE to ST_XPU_INFO

PROPERTY AllModulesDcLink : REFERENCE to BOOL

PROPERTY RailLength : REFERENCE to LREAL

PROPERTY CaGroupOID : REFERENCE to OTCID

PROPERTY XpuInstance : REFERENCE to UINT

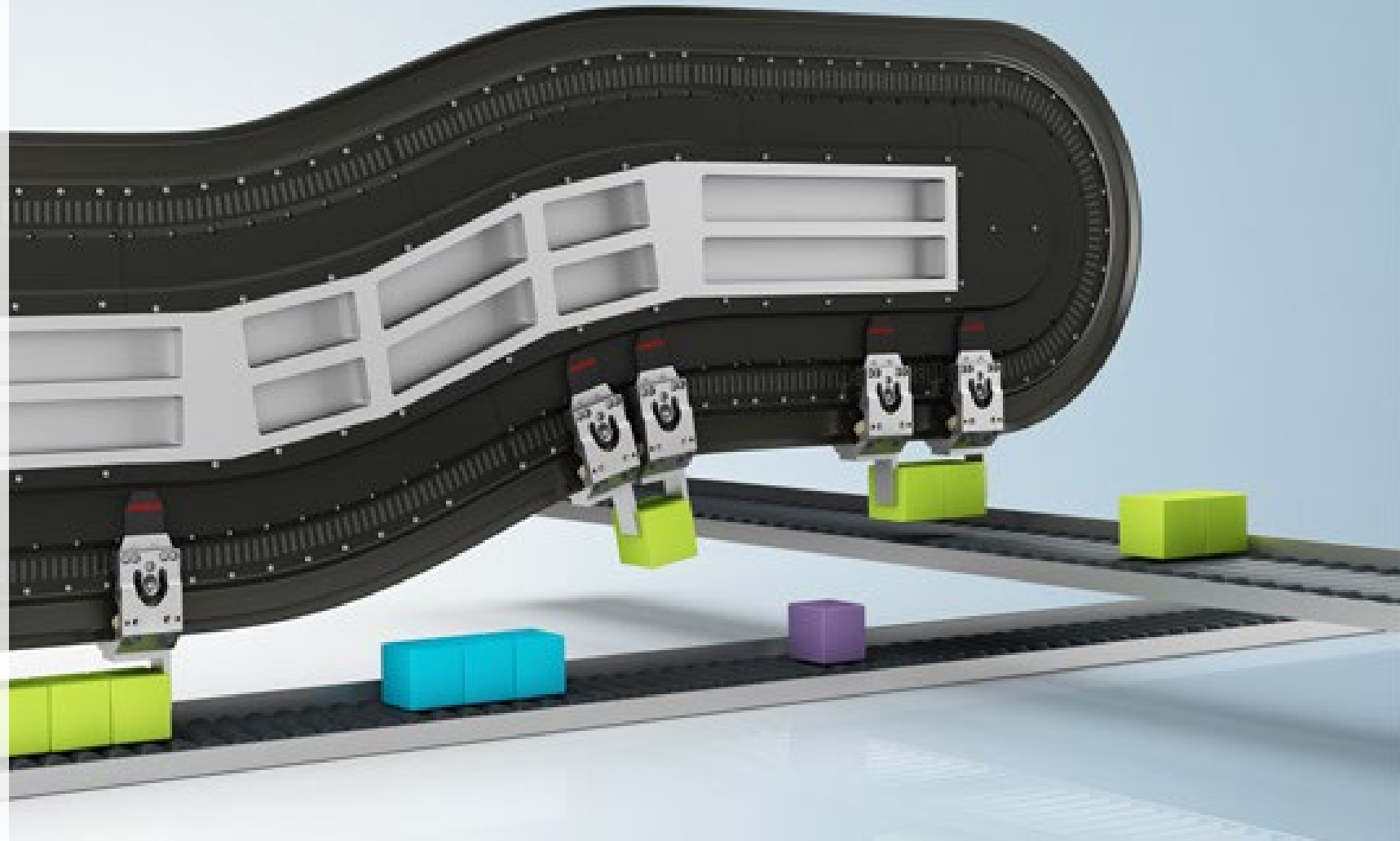


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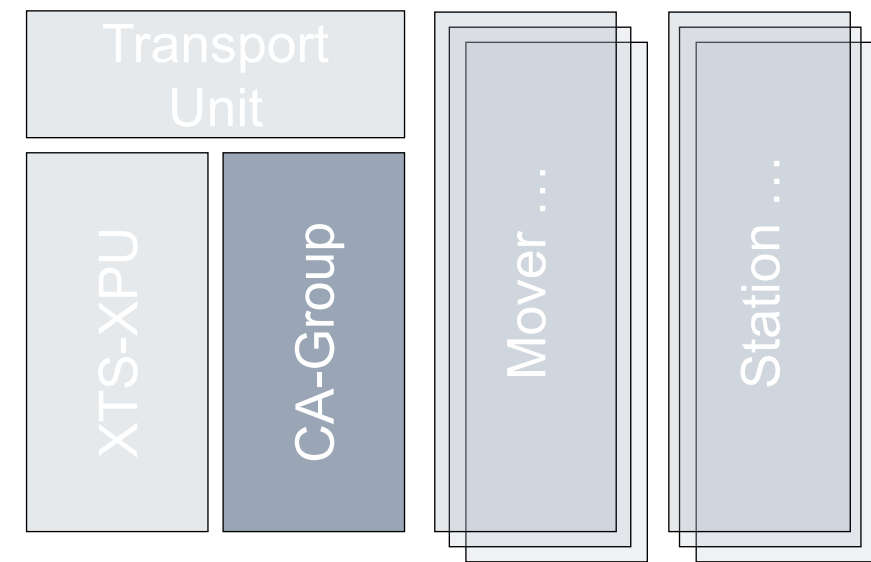
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CA-Group

- The CA-Group Object handle communication and function with the CA-Group at the motion
 - Cycle Interface
 - Administrative Group function
 - Group handling



CA-Group

- The CA-Group Object handle these methods

METHOD Cycle

METHOD Enable

METHOD Disable

METHOD AddAll

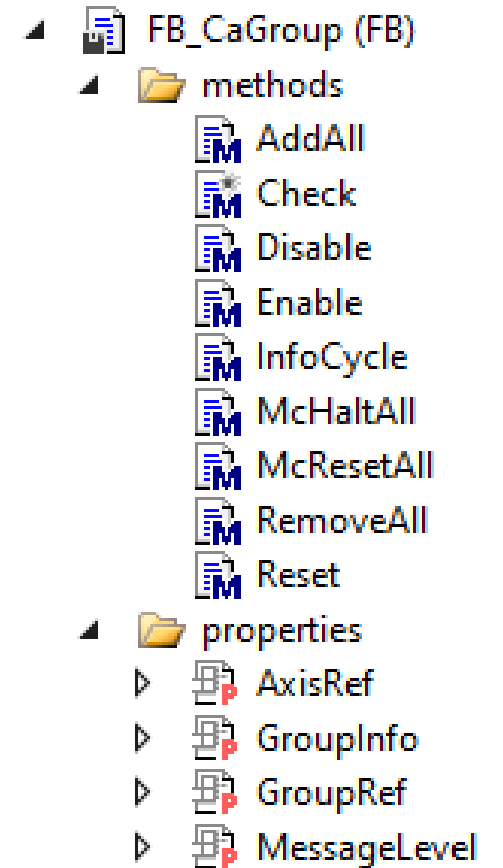
METHOD RemoveAll

METHOD McHaltAll

METHOD MCRResetAll

METHOD MCHaltAll

METHOD Reset



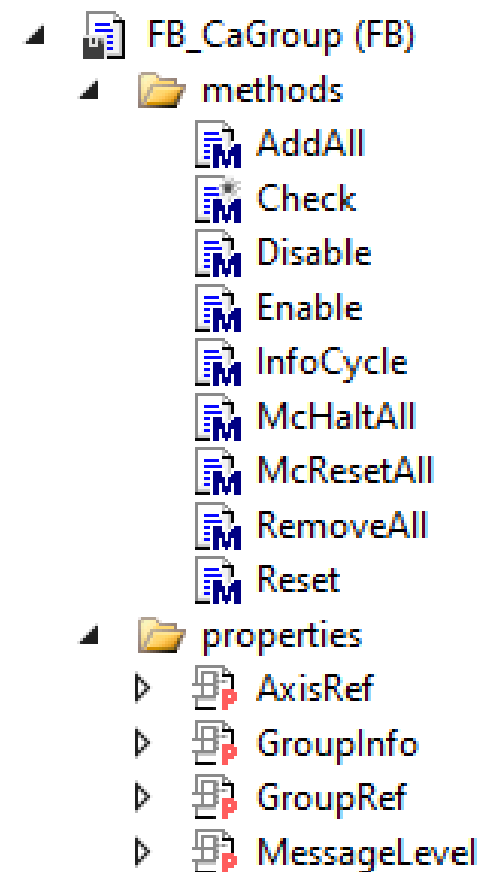
CA-Group

- The CA-Group Object handle these properties

PROPERTY AxisRef : REFERENCE TO ARRAY [1..MAX_Mover]
OF AXIS_REF

PROPERTY GroupRef : REFERENCE to Axes_Group_Ref

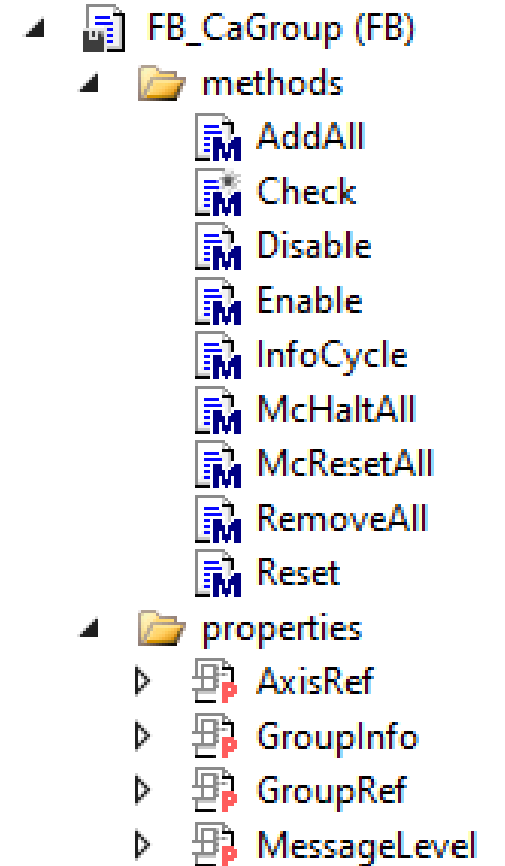
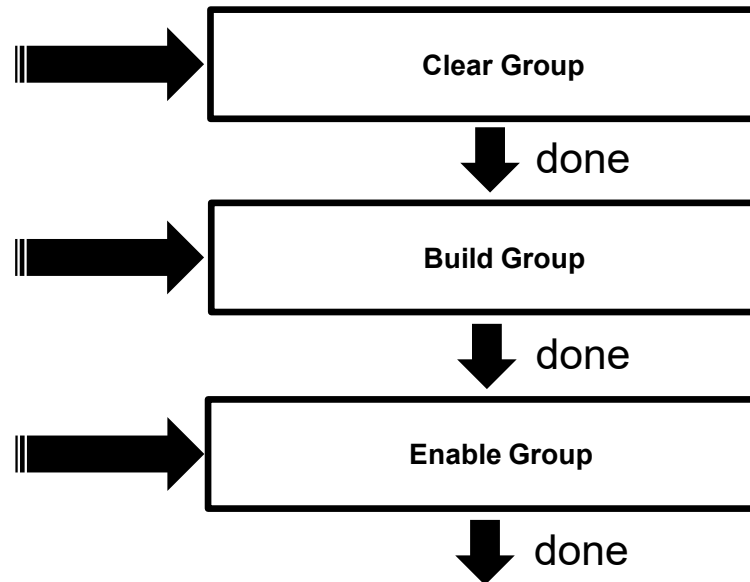
PROPERTY GroupInfo : REFERENCE to ST_GROUP_INFO



CA-Group

■ CA-Group workflow

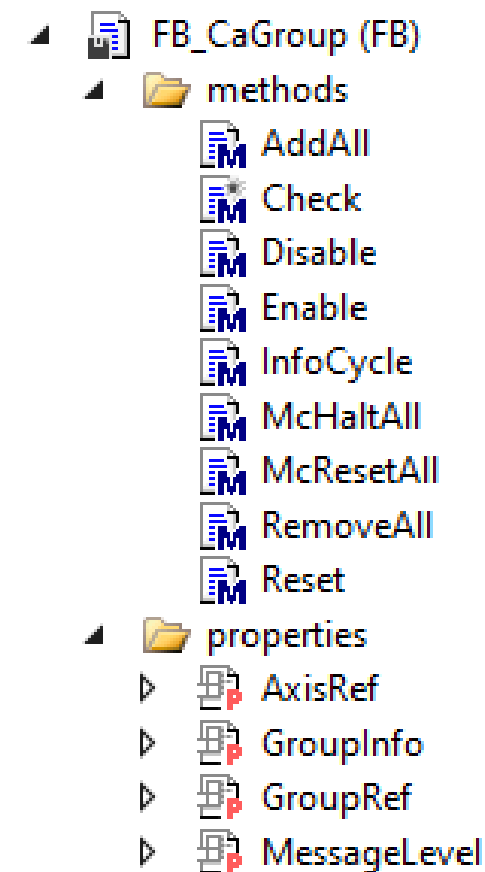
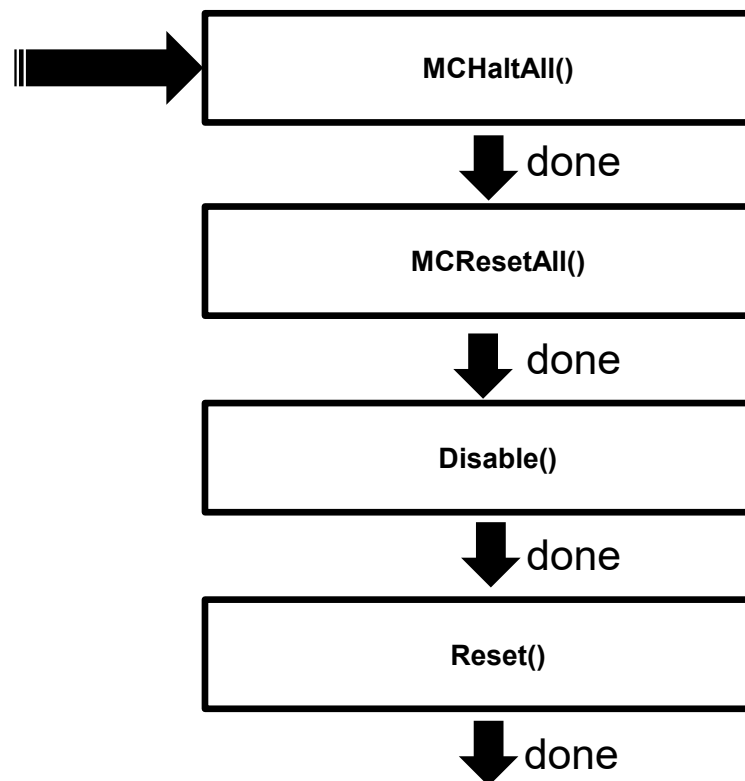
- Clear Group
- Build Group
- Enable Group



CA-Group

- CA-Group workflow

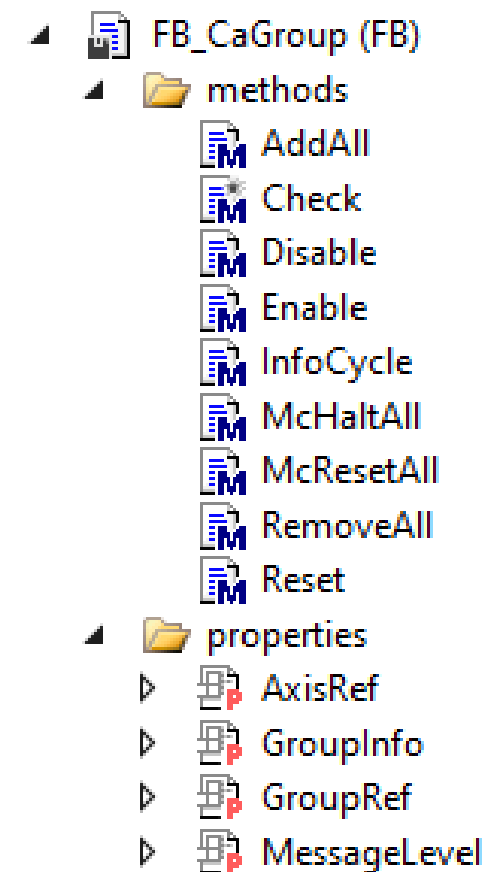
- Clear Group



CA-Group

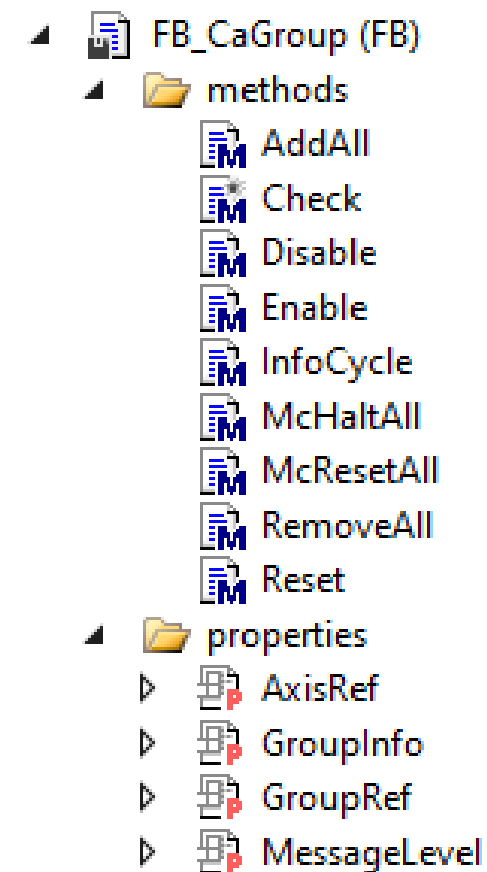
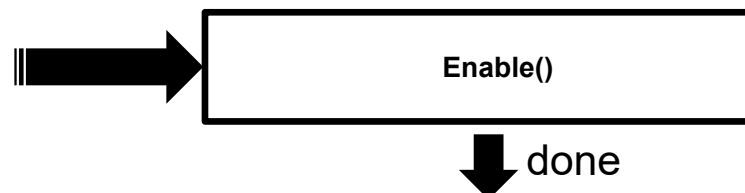
- CA-Group workflow

- Build Group



CA-Group

- CA-Group workflow
 - Enable Group

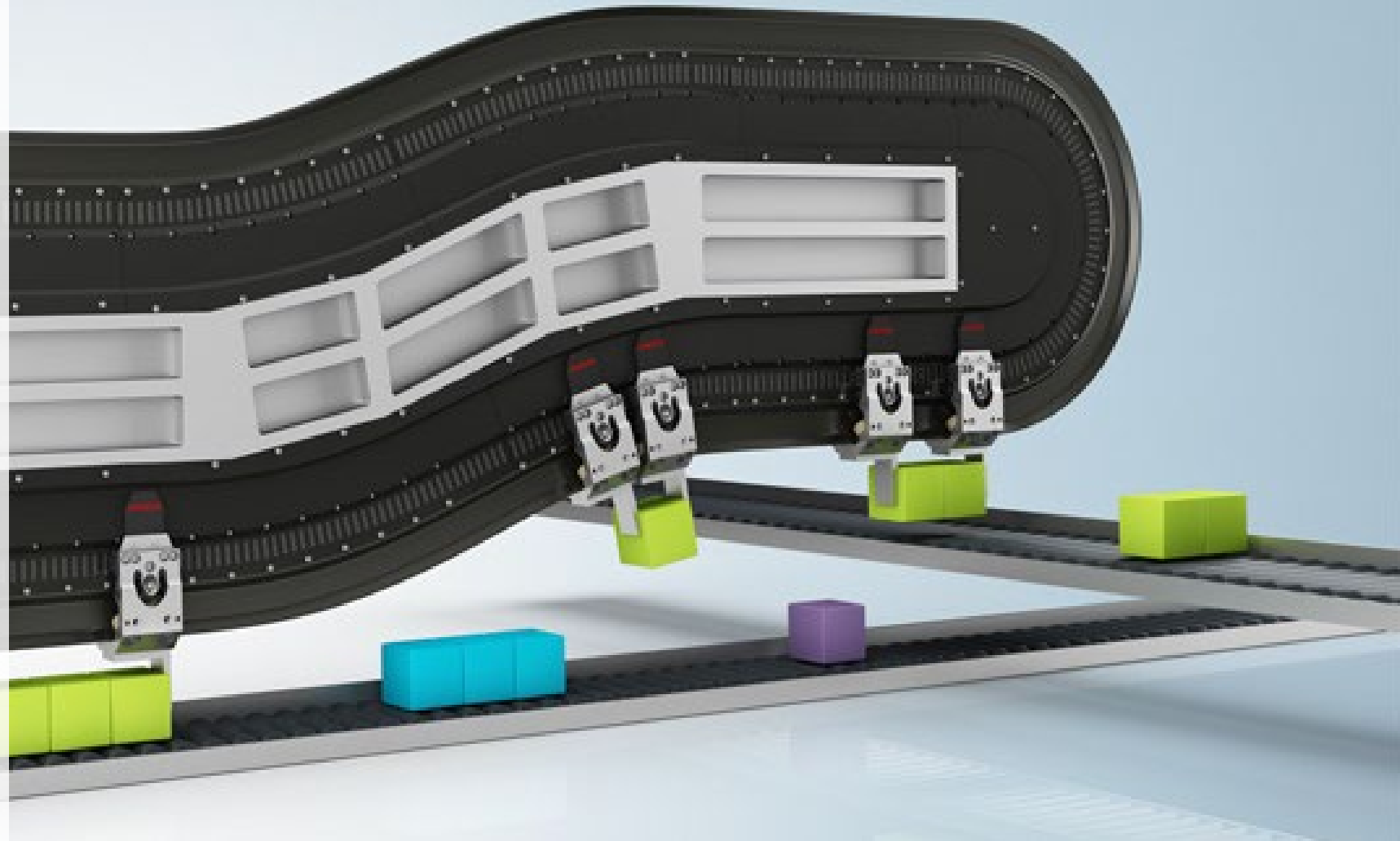


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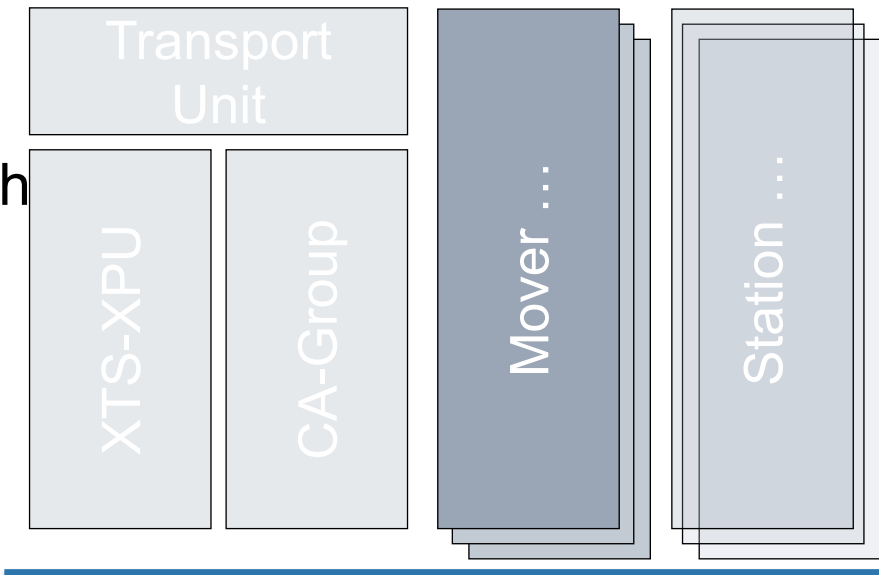
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Mover Object

- The Mover Object handle communication and function with the Mover Object at the motion
 - Cycle Interface
 - Administrative Mover function
 - Move Command's
 - ...



Mover Object

- The Mover Object handle these methods

METHOD Cycle

METHOD Disable

METHOD Enable

METHOD GearIn / METHOD GearInPosCa / METHOD GearOut

METHOD Halt

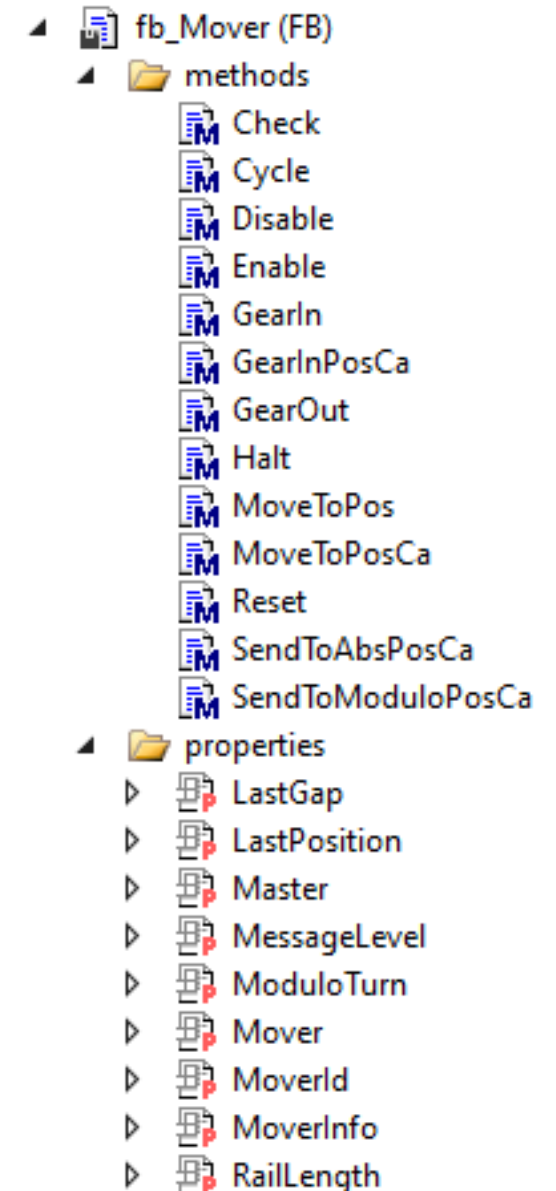
METHOD HaltCa

METHOD MoveToPosCa (with arrival at destination)

METHOD SendToPosCa (without destination arrival → send only)

METHOD Reset

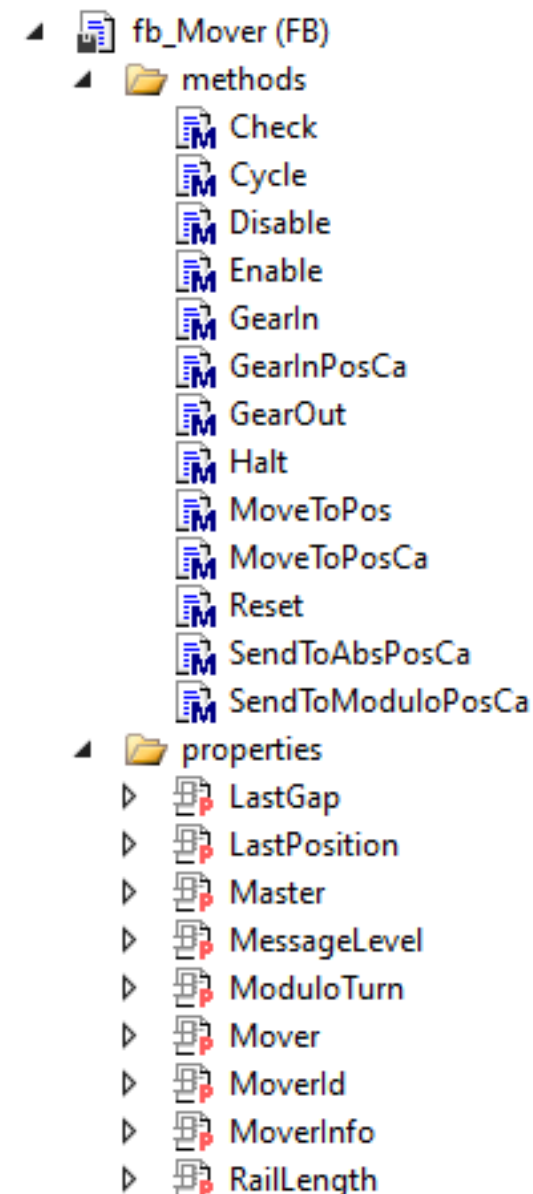
METHOD MoveToPos (without CA)



Mover Object

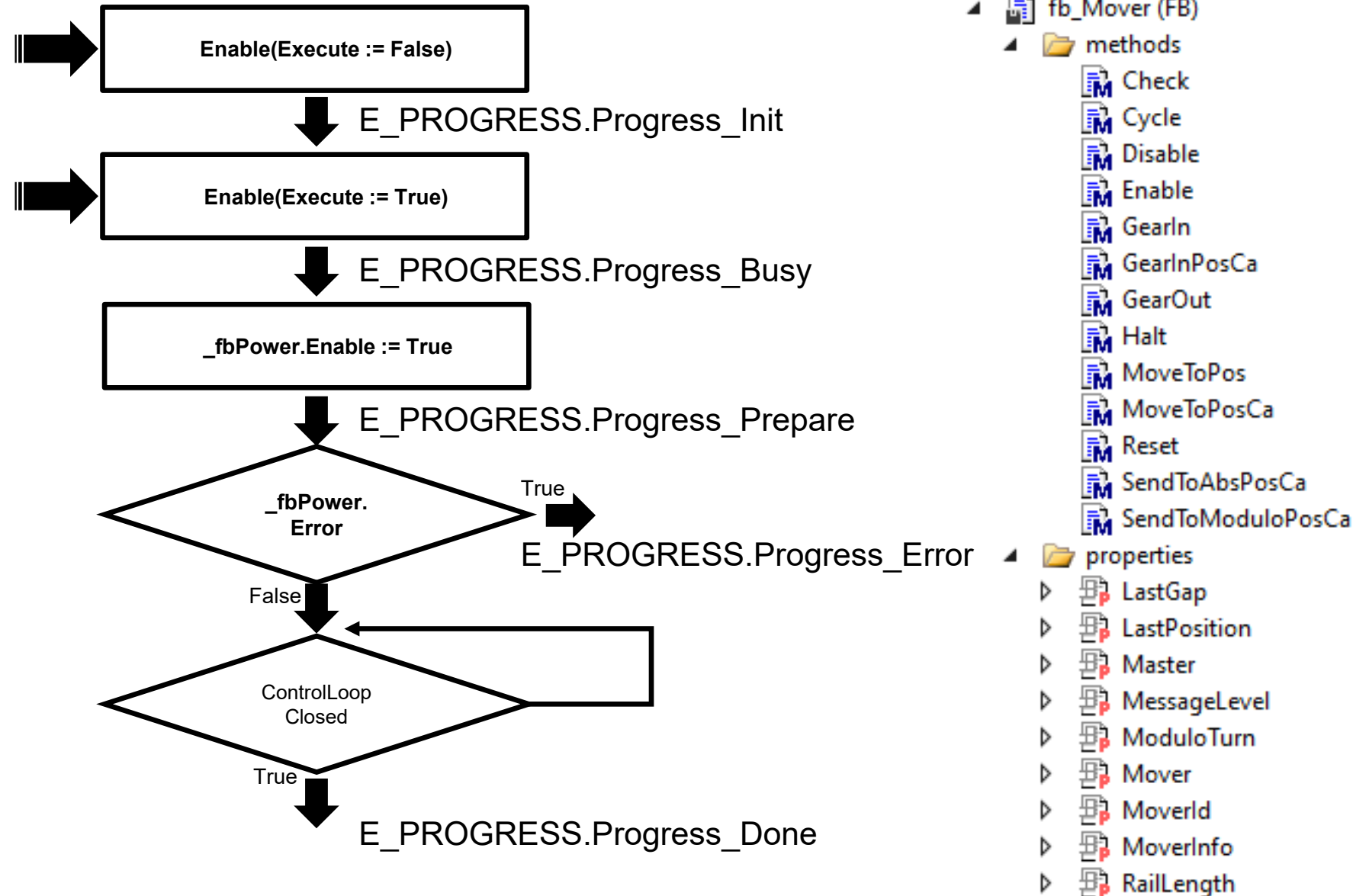
- The Mover Object handle these properties

PROPERTY	LastGap	:	REFERENCE	to	LREAL
PROPERTY	LastPosition	:	REFERENCE	to	LREAL
PROPERTY	Master	:	REFERENCE	to	AXIS_REF
PROPERTY	Mover	:	REFERENCE	to	AXIS_REF
PROPERTY	RailLength	:	REFERENCE	to	LREAL
PROPERTY	MoverInfo	:	REFERENCE	to	ST_MOVER_INFO



Mover Object

- Workflow example
"Enable Mover"

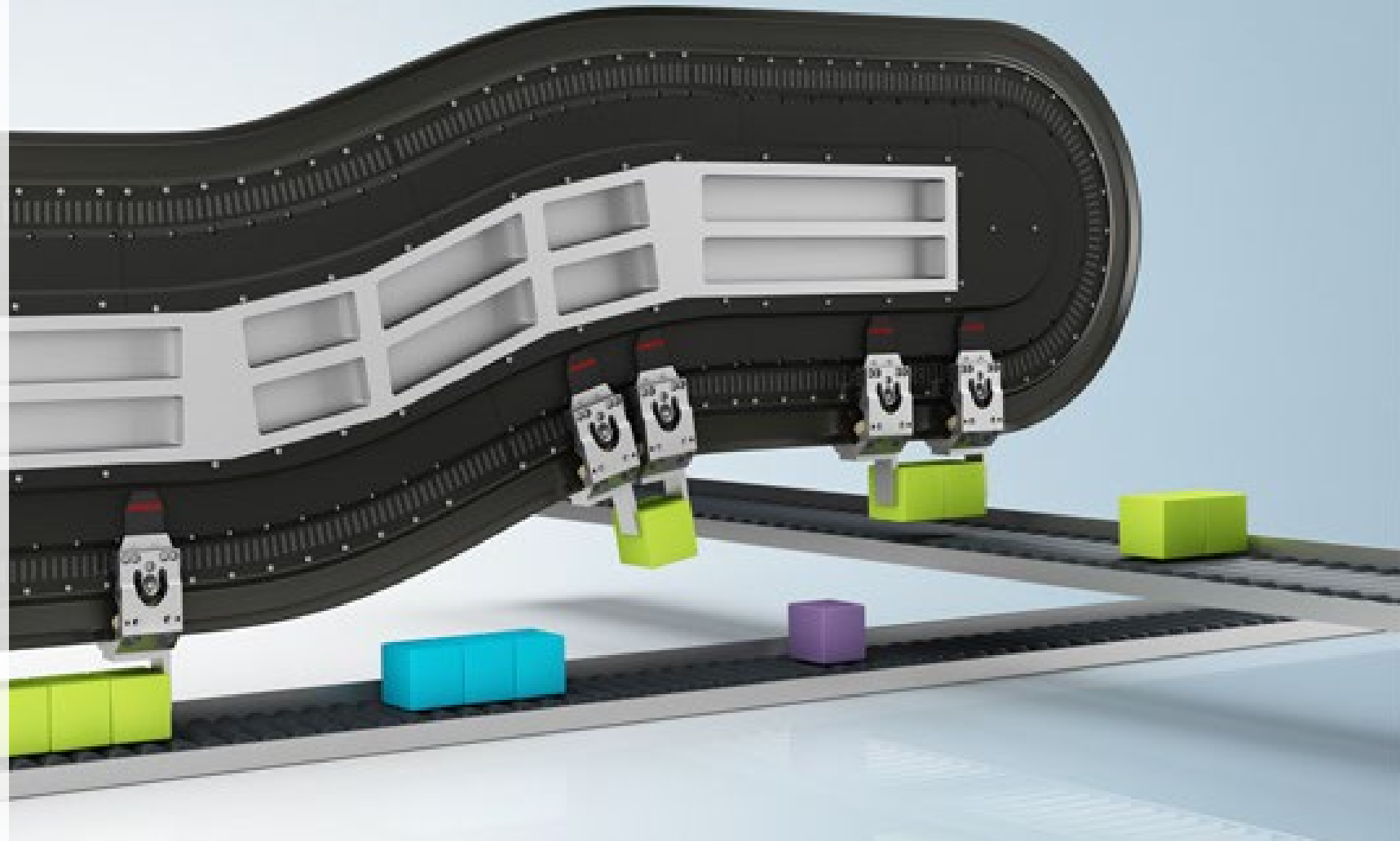


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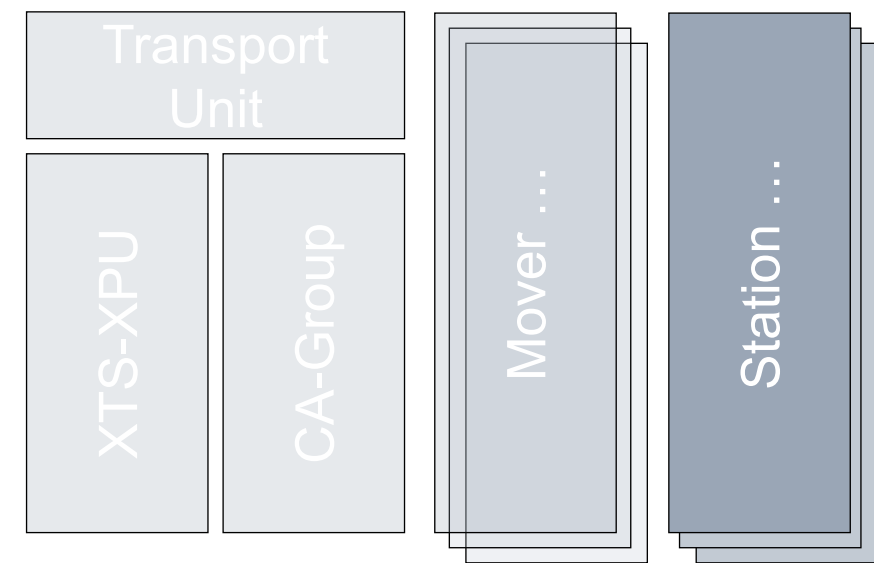
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Station Object

- The Station Object handle functionality and parameter of the Processing-Station
 - Process Parameter
 - concatenated list
 - Commands for the Mover



Station Object

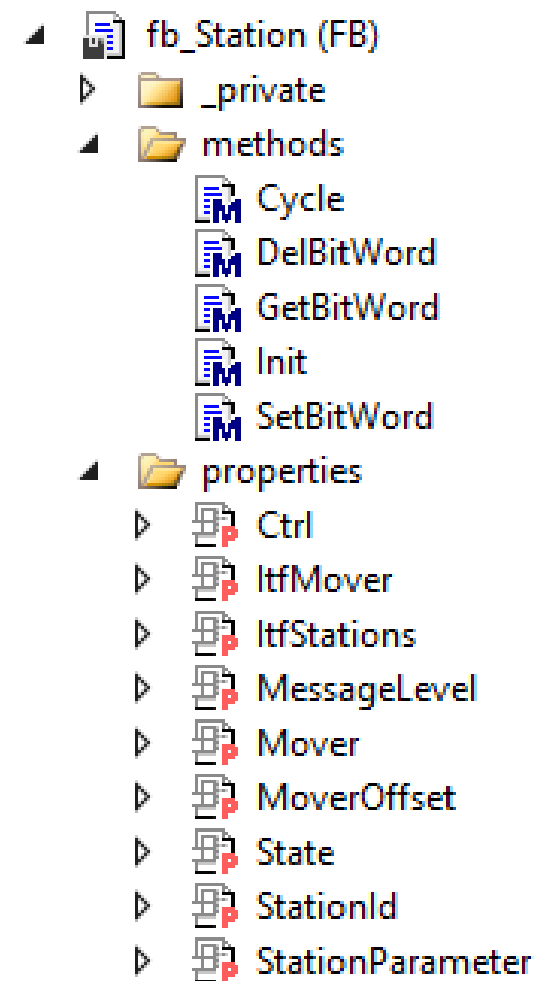
- The Station Object handle these methods

METHOD Cycle

METHOD DelBitWord

METHOD GetBitWord

METHOD SetBitWord



Station Object

- The Station Object handle these properties

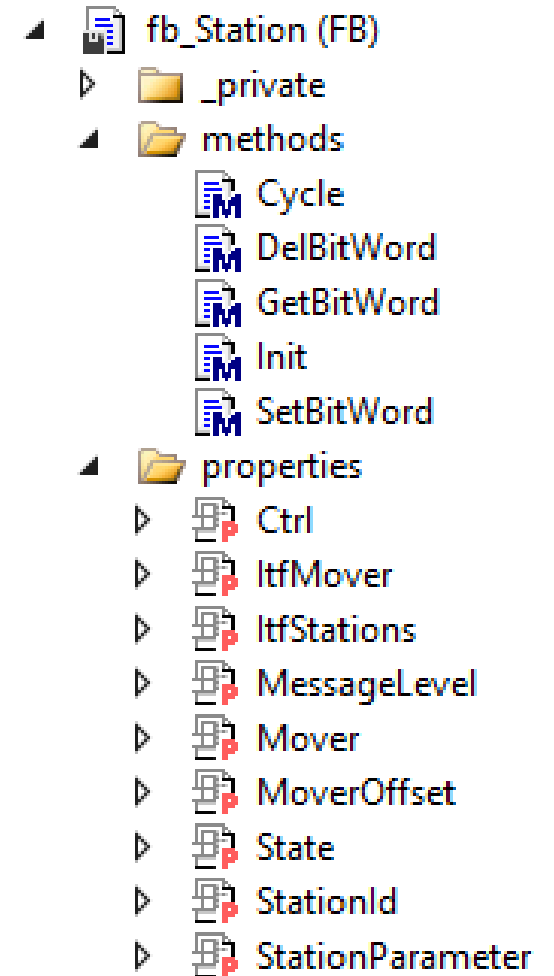
PROPERTY Ctrl : REFERENCE TO ARRAY [1..MAX_Stator
OF ST_Station_CTRL

PROPERTY Mover : REFERENCE TO ARRAY [1..MAX_Mover]
OF AXIS_REF

PROPERTY State : REFERENCE TO ARRAY [1..MAX_Stator
OF ST_Station_State

PROPERTY StationParameter : REFERENCE TO ARRAY [1..MAX_Stator
OF ST_Station_Parameter

PROPERTY StationId : UINT

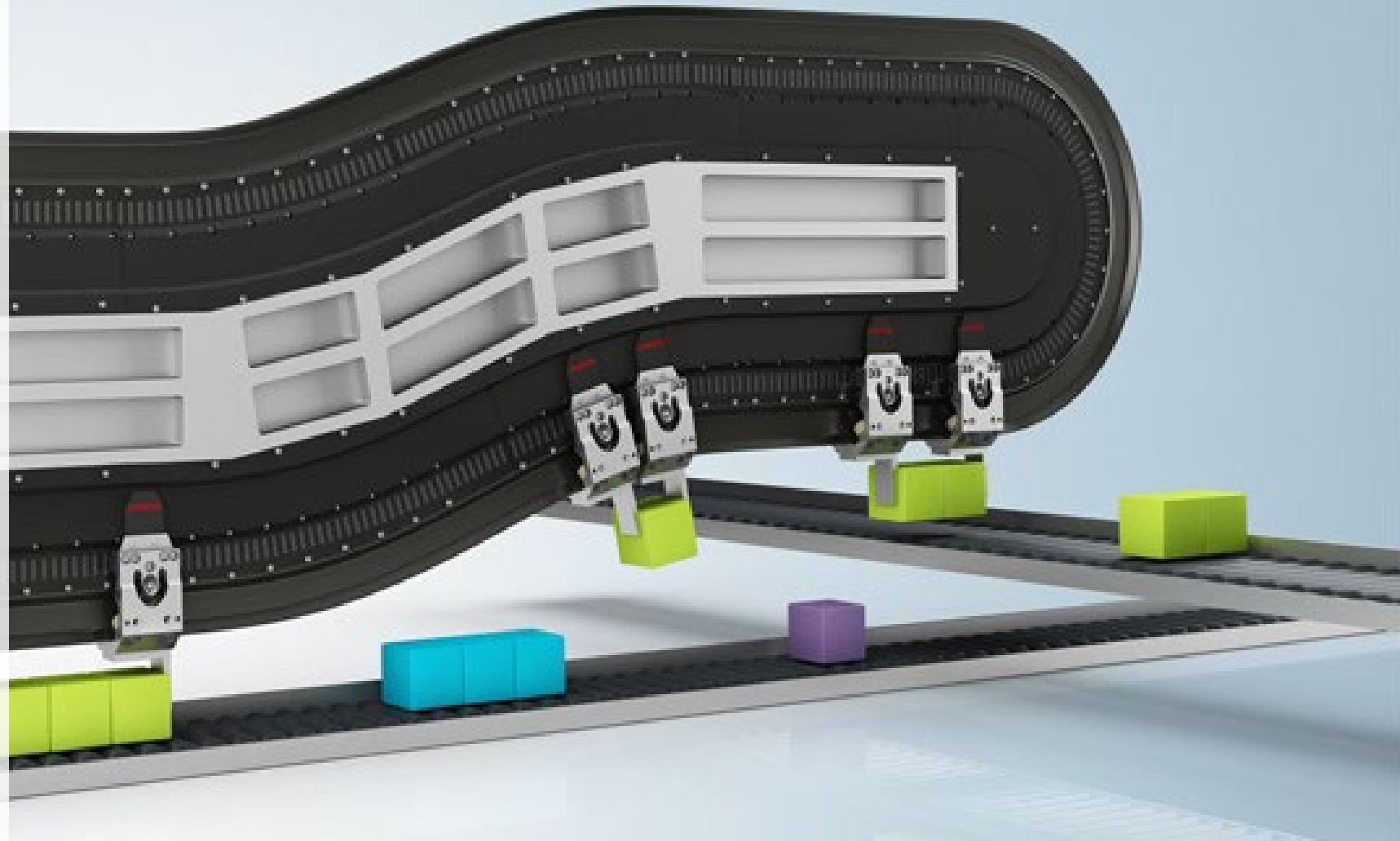


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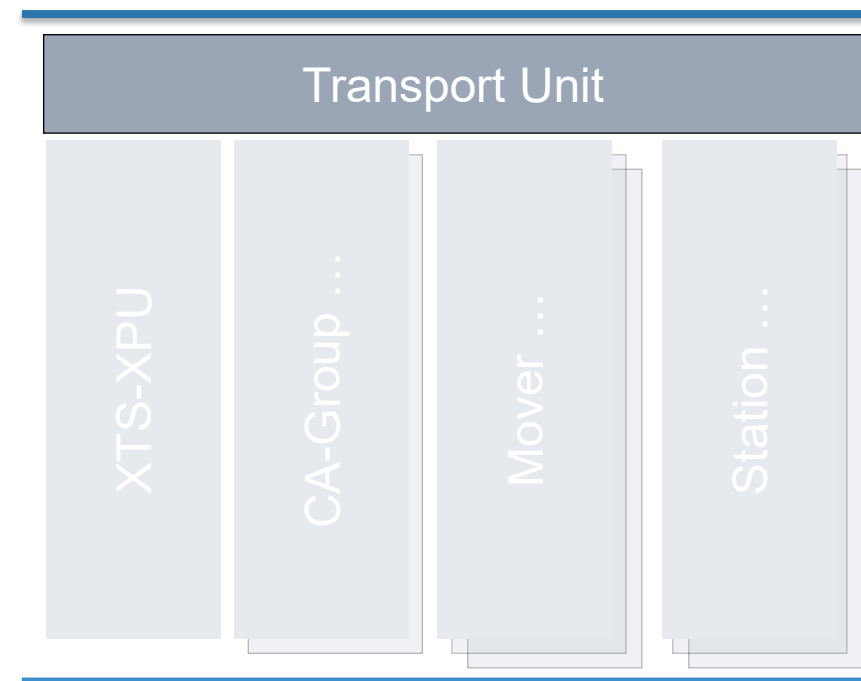
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7. **Transport Unit**



Transport Unit

- The Transport Unit handle the communication between the XTS-Transport Layer and the Application of the Processing Parts
 - Communication
 - Transport Layer definition
 - ...



Transport Unit

- The Station Object handle these methods

METHOD XpuInit

METHOD GroupClear

METHOD GroupBuild

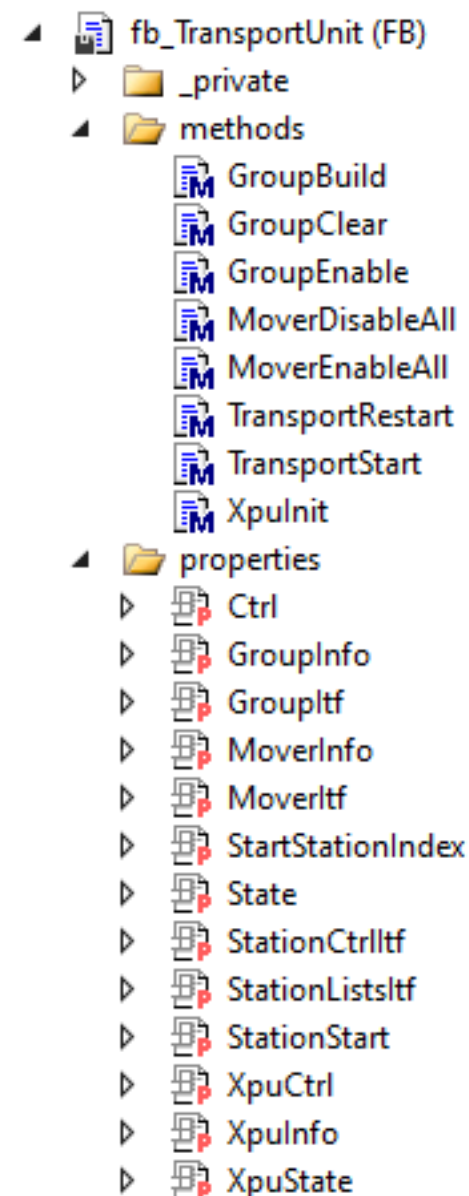
METHOD GroupEnable

METHOD MoverEnableAll

METHOD MoverDisableAll

METHOD TransportStart

METHOD TransportRestart



Transport Unit

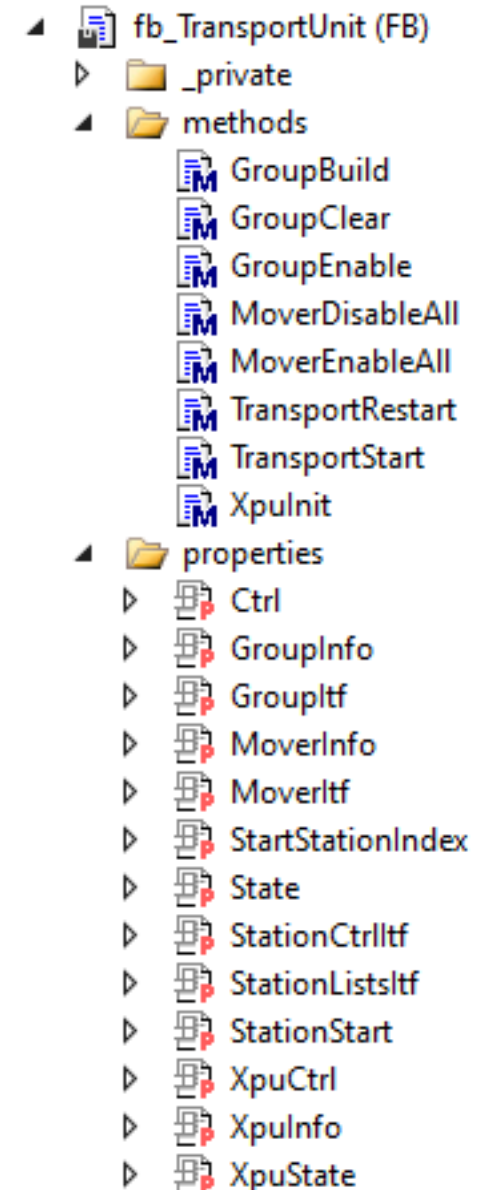
- The Station Object handle these properties

➤ Communication TransportUnit ↔ Applikation

PROPERTY Ctrl : REFERENCE to ST_XTS_Transport_Ctrl
PROPERTY State : REFERENCE to ST_XTS_Transport_State

➤ Handling XPU

PROPERTY XpuCtrl : REFERENCE to AXIS_REF
PROPERTY XpuState : REFERENCE to AXIS_REF
PROPERTY XpuInfo

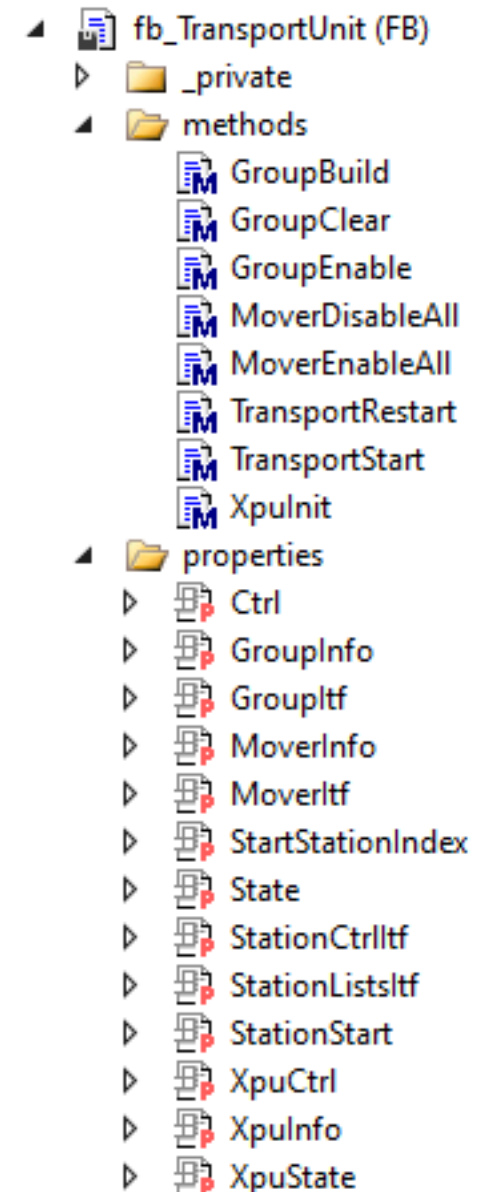


Transport Unit

- The Station Object handle these properties

➤ Handling CA-Group

PROPERTY : REFERENCE to ST_XTS_Transport_Ctrl
PROPERTY : REFERENCE to ST_XTS_Transport_State



Transport Unit

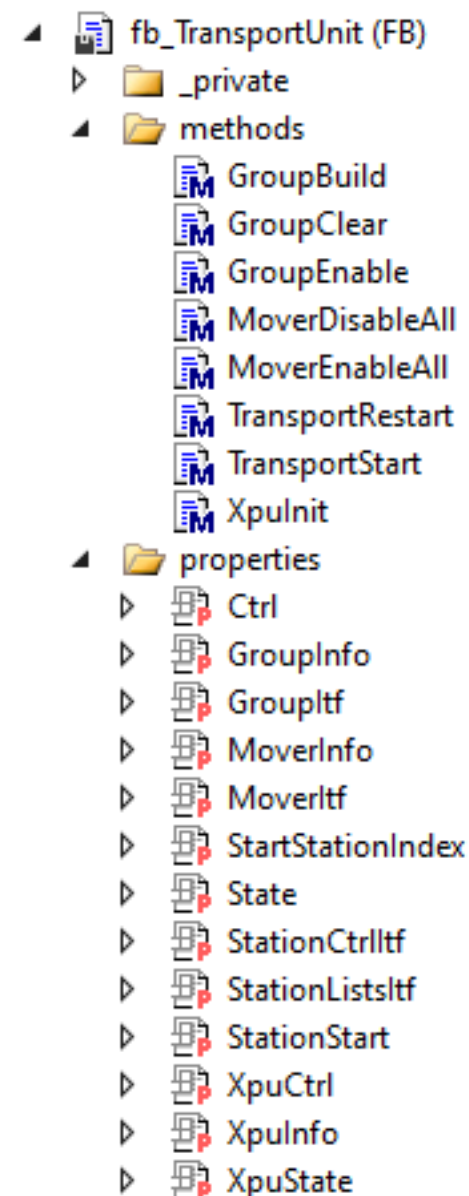
- The Station Object handle these properties

➤ Handling Mover

PROPERTY : REFERENCE to ST_XTS_Transport_Ctrl
PROPERTY : REFERENCE to ST_XTS_Transport_State

➤ Handling Station

PROPERTY : REFERENCE to AXIS_REF
PROPERTY : REFERENCE to AXIS_REF
PROPERTY





**Complex sequences – simplified solution:
XTS**

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