



Migration Guide
PROFINET IO Device
Migration from V3.4 to V3.7

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1 Introduction

1.1 About this document

This document describes the steps required to migrate an existing PROFINET IO Device application from stack/firmware Version V3.4 to V3.7.

1.2 List of revisions

Rev	Date	Name	Chapter	Revision
1	2012-06-25	BM/HH	all	Created
2	2012-10-31	BM	All	Corrected (sub)module IDs, editorial changes Added PNS_IF_LINK_STATUS_CHANGE_IND to services that changed
3	2013-04-10	BM	All	Rework of whole document to meet current development state of stack V3.5.14.0
4	2013-11-19	BM	All	Document updated to meet current development state of stack 3.5.20.0 <ul style="list-style-type: none"> ▪ Section regarding IRT support updated (IRT was not supported in the first version of V3.5) ▪ Section describing unsupported services removed (PNS_IF_SET_SUBM_STATE_REQ was not supported in first versions of V3.5)
5	2013-12-11	BM	4.1, 5.2	Added remark that service PNS_IF_GET_DEVICE_HANDLE_REQ does not longer exists Adapted startup parameters for stack V3.5.27.0
6	2014-06-04	AR	3,5.2	Startup parameters for stack V3.5.38.0 adapted Changed priorities of the task for robustness regarding net load Document updated for PROFINET IO-Device V3.7 (further development from 3.5)

Table 1: List of revisions

1.3 References to documents

This document refers to the following documents:

- [1] Hilscher Gesellschaft für Systemautomation mbH: Protocol API, PROFINET IO RT/IRT Device, V3.7.x.x, Revision 11, English, 2015.

Table 2: References to documents

1.4 Legal notes

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2 General

The PROFINET IO Device Firmware/Stack V3.5 supports *Shared Device* as a new feature. This means that firmware/Stack V3.5 supports 2 IO ARs at the same time. Therefore an application must be able to deal with requests of multiple application relations (AR) at the same time. For packet communication the field `hDeviceHandle` is used by the firmware/stack to indicate the associated Application Relation.

Multiple ARs require some handling of ownership. Only one AR is allowed to write data to an output, otherwise inconsistent data might be sent to a submodule. This ownership handling is done inside the PROFINET IO Device stack and completely hidden from the user.

Special care needs to be taken by application when handling `PNSIF_CHECK_IND` packets. This packet indicates a difference between local submodule configuration and expected submodule configuration of IO Controller. Firmware/Stack V3.4 only generated this packet during connection establishment. Only one application relation was supported by firmware/stack V3.4. There was only a small timeslot when this indication was created. As a result of the feature *shared device* these indications are now **additionally** generated by stack/firmware V3.5 in different situations.

- One AR exists, another AR is established. A submodule not locally plugged is requested by the second AR. Now a check indication is sent to the user application although there is an AR already established. This is context of an additional AR establishment.
- One AR exists, another AR is established. The first AR expects output submodule in slot 1 subslot 1. The second AR expects a different output submodule in slot 1 subslot 1. At first the second IO Controller will be informed that the submodule cannot be used and no check indication is generated. If the first AR breaks down now, the firmware/stack will generate a check indication to the user application and inform the user about the difference between expected and real configuration. This check indication is generated completely out of the context of AR establishment.

The cyclic data exchange with multiple application relations is handled by the firmware/stack V3.5 internally in the following ways (according to the PROFINET specification):

- For outputs, only the data of the submodules owner AR is copied into the dual-port memory input area/consumer image
- For inputs, the data is copied from the dual-port memory output area/provider image only to the submodule owner's AR. The feature "Shared Input" is not supported!

The parameter record access is also controlled by the ownership:

- Parameter writes (`PNS_IF_WRITE_RECORD_REQ`) are only allowed from the submodules owner AR. Requests from other ARs will be filtered by firmware/stack automatically.
- Parameter reads (`PNS_IF_READ_RECORD_REQ`) are allowed from all ARs.

2.1 IRT

The PROFINET IO Device firmware/stack V3.5 uses a new IRT technology called *Relative Forwarder* whereas the firmware/stack V3.4 implemented an *Absolute Forwarder*. Therefore, if the application uses IRT, the GSDML file must be adapted (see section *GSDML device description* on page 8).

Important: If an existing IRT capable device is upgraded from a firmware/stack V3.4 based firmware to a firmware/stack V3.5 based firmware, the PROFINET IO Controllers configuration must be updated using the new GSDML file.

It is NOT possible to simply replace a device based on stack/firmware V3.4 with one of stack/firmware v3.5 when IRT is used. In this situation the new GSDML file needs to be imported in the engineering and the project in engineering needs to be newly calculated and downloaded to the IO-Controller using the new GSDML file.

3 GSDML device description

As stated above, if the application supports IRT, the GSDML file must be updated to Version 2.31 because older GSDML versions do not support the *Relative Forwarder* technology. Besides that the new Stack supports multiple ARs (*Shared Device*). Both features require, that the following parameters should be used for the interface submodule.

```
<InterfaceSubmoduleItem
  DCP_HelloSupported="true"
  ID="DIM 20 Interfacesubmodule"
  NetworkComponentDiagnosisSupported="true"
  SubmoduleIdentNumber="0x00002061"
  SubslotNumber="32768"
  SupportedMibs="MIB2"
  SupportedProtocols="SNMP;LLDP"
  SupportedRT_Classes="RT_CLASS_1;RT_CLASS_3"
  TextId="PN-IO">

  <RT_Class3Properties
    ForwardingMode="Relative"
    MaxBridgeDelay="5500"
    MaxNumberIR_FrameData="256"
    StartupMode="Legacy" />

  <SynchronisationMode
    MaxLocalJitter="50"
    SupportedRole="SyncSlave"
    SupportedSyncProtocols="PTCP"
    T_PLL_MAX="1000" />

  <ApplicationRelations
    NumberOfAR="2"
    StartupMode="Advanced;Legacy">

  <TimingProperties
    ReductionRatio="1 2 4 8 16 32 64 128 256 512"
    SendClock="32 64 128"/>

  <RT_Class3TimingProperties
    ReductionRatio="1 2 4 8 16"
    SendClock="8 16 32 64 128"/>
</ApplicationRelations>

  <MediaRedundancy SupportedRole="Client"/>
</InterfaceSubmoduleItem>
```

As a further consequence of this new IRT technology, Hilscher has assigned new module and submodule ident numbers to the device access point. If the stack is configured using the netX Configuration Tool, the following numbers shall be used by the application to match Hilscher default values for cifX:

Description	Value for V3.4	Value for V3.5.35, V3.7
DAP ModuleIdentNumber	0x00001001 or 0x00001101	0x00002081
DAP SubmoduleIdentNumber	0x00001000 or 0x00001100	0x00002080
Interface SubmoduleIdentNumber	0x00001001 or 0x00001101	0x00002081
Port 1 SubmoduleIdentNumber	0x00001002 or 0x00001102	0x00002082
Port 2 SubmoduleIdentNumber	0x00001003 or 0x00001103	0x00002083

Table 3: Module/Submodule Ident Number Comparison Firmware/Stack V3.4 and V3.5

Usage of other moduleidentnumbers or submoduleidentnumbers is possible as well.

4 Packet handling

No incompatible changes are done by firmware/stack V3.5.

4.1 Services having structural changes compared to V3.4

The following services have been changed or extended:

Changed Service	Description
PNS_IF_SET_CONFIGURATION_REQ / PNS_IF_SET_CONFIGURATION_CNF	Set Configuration Service (support of IOCS configuration)
PNS_IF_SET_IOXS_CONFIG_REQ / PNS_IF_SET_IOXS_CONFIG_CNF	Set IOxS Config Service (support of IOCS configuration)
PNS_IF_SET_OEM_PARAMETERS_REQ / PNS_IF_SET_OEM_PARAMETERS_CNF	Set OEM Parameters Service
PNS_IF_LINK_STATE_CHANGE_IND / PNS_IF_LINK_STATE_CHANGE_RES	Link state change indication replaced with generic rcX packet RCX_LINK_STATUS_CHANGE_IND / RCX_LINK_STATUS_CHANGE_RES
PNS_IF_GET_DEVICE_HANDLE_REQ / PNS_IF_GET_DEVICE_HANDLE_CNF	This service does no longer exist in stack V3.5.

Table 4: Changes Packets/Services

4.2 Services that can be issued in parallel

As already stated, the protocol firmware/stack V3.5 (and higher) now supports multiple ARs at the same time. Each AR is assigned a specific device handle (`hDeviceHandle`) which may be used to relate indications and requests with a specific AR. One import consequence of this new feature is that the application must be able to deal with multiple indications of the same type at the same time. This comes into account if the application stores a packet for a time before returning it back to the stack. The following services are affected by this behavior:

Affected Service	Description
PNS_IF_PARAM_END_IND / PNS_IF_PARAM_END_RES	Parameter End Service
PNS_IF_SET_APPL_READY_REQ / PNS_IF_SET_APPL_READY_CNF	Application Ready Service
PNS_IF_AR_CHECK_IND / PNS_IF_AR_CHECK_RES	AR Check Service
PNS_IF_AR_INDATA_IND / PNS_IF_AR_INDATA_RES	AR InData Service
PNS_IF_AR_ABORT_IND / PNS_IF_AR_ABORT_RES	AR Abort Service
PNS_IF_APDU_STATUS_IND / PNS_IF_APDU_STATUS_RES	APDU Status Service
PNS_IF_ALARM_IND / PNS_IF_ALARM_RES	Alarm Service
PNS_IF_READ_IM_IND / PNS_IF_READ_IM_RES	Read Identification & Maintenance Service
PNS_IF_WRITE_IM_IND / PNS_IF_WRITE_IM_RES	Write Identification & Maintenance Service
PNS_IF_READ_RECORD_IND / PNS_IF_READ_RECORD_RES	Read Record Service
PNS_IF_WRITE_RECORD_IND / PNS_IF_WRITE_RECORD_RES	Write Record Service
PNS_IF_PARAM_BEGIN_IND / PNS_IF_PARAM_BEGIN_RES	Parameter Begin Service
PNS_IF_CONNECT_REQ_DONE_IND / PNS_IF_CONNECT_REQ_DONE_RES	Connect Request Done Service
PNS_IF_RELEASE_RECV_IND / PNS_IF_RELEASE_RECV_RES	Release Received Service

Table 5: Packets/Services affected by `hDeviceHandle`

5 Interface dependent changes

5.1 Dual-port memory

As a consequence of the Shared Device feature, the COMMUNICATING-Bit is handled as follows:

- The COMMUNICATING-Bit is set when the first AR enters valid Data-Exchange
- The COMMUNICATING-Bit is cleared when the last AR is shut down

5.2 Linkable Object Module

The internal structure of stack V3.5 has changed in many ways so that several changes are required when using the *Linkable Object Module* (LOM).

**Note:**

When using the LOM, it is not possible to use the stack with the standard two-port switch of the rcX operating system.

When using the LOM, it is not possible to use the stack with the standard MAC of rcX.

This means that the stack can **exclusively** be used with the switch integrated within the Profinet IO-Device Stack. As a consequence, in any case three XC channels are required at the netX 100 and netX 500!

At first, the following versions of additional Components are required:

Component	Version
rcX Operating System	2.0.8.19 or greater for netX500, netX100 and netX50 2.1.10.0 or greater for netX51
TCP/IP Stack	2.1.30.0 or greater

Table 6: Required components for Linkable Object Module

**Note:**

This Migration Guide may not always be up-to-date regarding Linkable Object Module integration. Please refer to the latest available API Manual of the Profinet IO Device Protocol stack.

5.2.1 Stack configuration and initialization

Stack V3.5 and higher uses a new initialization and startup sequence. The stack is not started using the *Static Task List* but by invoking a single function from the application. This simplifies starting the stack greatly.



Note:

If the shared memory API is used, the PROFINET IO Device Stacks AP task will start the stack.

In order to adapt to the new stack, all PROFINET protocol stack tasks shall be removed from the static tasks list at first. Furthermore, the following hardware settings need to be changed. For a full list of the recommended rcX configuration please see document reference [1].

Stack V3.5 and higher uses the “System Time Compare” interrupt to trigger RT&IRT scheduler, so it should be defined explicitly in the interrupt set. The interrupt set should include interrupts for the EDD driver (from xC channels 0, 1 and 3). The following settings are recommended (when using netX100/500):

```

STATIC FAR RX_INTERRUPT_SET_T atrXInt[] = {
    /* MSYNC */
    {{"PNS_MSNC",RX_PERIPHERAL_TYPE_INTERRUPT,0}, /* Communication Channel, Instance 0 */
     SRT_NETX_VIC_IRQ_STAT_msnc0, /* Motion synchronization channel 0 */
     17, /* Priority 17 */
     RX_INTERRUPT_MODE_SYSTEM, /* Interrupt mode */
     RX_INTERRUPT_EOI_AUTO, /* EOI self by RX */
     RX_INTERRUPT_TRIGGER_RISING_EDGE, /* Edge triggered */
     RX_INTERRUPT_PRIORITY_STANDARD, /* Normal Priority */
     RX_INTERRUPT_REENTRANCY_DISABLED, /* Interrupt itself is not reentrant */
    },
    {{"PNS_MSNC",RX_PERIPHERAL_TYPE_INTERRUPT,1}, /* Communication Channel, Instance 1 */
     SRT_NETX_VIC_IRQ_STAT_msnc1, /* Motion synchronization channel 1 */
     18, /* Priority 18 */
     RX_INTERRUPT_MODE_SYSTEM, /* Interrupt mode */
     RX_INTERRUPT_EOI_AUTO, /* EOI self by RX */
     RX_INTERRUPT_TRIGGER_RISING_EDGE, /* Edge triggered */
     RX_INTERRUPT_PRIORITY_STANDARD, /* Normal Priority */
     RX_INTERRUPT_REENTRANCY_DISABLED, /* Interrupt itself is not reentrant */
    },
    {{"PNS_MSNC",RX_PERIPHERAL_TYPE_INTERRUPT,3}, /* Communication Channel, Instance 3 */
     SRT_NETX_VIC_IRQ_STAT_msnc3, /* Motion synchronization channel 3 */
     19, /* Priority 19 */
     RX_INTERRUPT_MODE_SYSTEM, /* Interrupt mode */
     RX_INTERRUPT_EOI_AUTO, /* EOI self by RX */
     RX_INTERRUPT_TRIGGER_RISING_EDGE, /* Edge triggered */
     RX_INTERRUPT_PRIORITY_STANDARD, /* Normal Priority */
     RX_INTERRUPT_REENTRANCY_DISABLED, /* Interrupt itself is not reentrant */
    },
    /* COM */
    {{"PNS_COM",RX_PERIPHERAL_TYPE_INTERRUPT,0}, /* Communication Channel, Instance 0 */
     SRT_NETX_VIC_IRQ_STAT_com0, /* External communication channel 0 */
     20, /* Priority 20 */
     RX_INTERRUPT_MODE_SYSTEM, /* Interrupt mode */
     RX_INTERRUPT_EOI_AUTO, /* EOI self by RX */
     RX_INTERRUPT_TRIGGER_RISING_EDGE, /* Edge triggered */
     RX_INTERRUPT_PRIORITY_STANDARD, /* Normal Priority */
     RX_INTERRUPT_REENTRANCY_DISABLED, /* Interrupt itself is not reentrant */
    },
    {{"PNS_COM",RX_PERIPHERAL_TYPE_INTERRUPT,1}, /* Communication Channel, Instance 1 */
     SRT_NETX_VIC_IRQ_STAT_com1, /* External communication channel 1 */
     21, /* Priority 21 */
     RX_INTERRUPT_MODE_SYSTEM, /* Interrupt mode */
     RX_INTERRUPT_EOI_AUTO, /* EOI self by RX */
     RX_INTERRUPT_TRIGGER_RISING_EDGE, /* Edge triggered */
     RX_INTERRUPT_PRIORITY_STANDARD, /* Normal Priority */
    }
};

```

```

    RX_INTERRUPT_REENTRANCY_DISABLED,          /* Interrupt itself is not reentrant */
},
{{ "PNS_COM",RX_PERIPHERAL_TYPE_INTERRUPT,3}, /* Communication Channel, Instance 1 */
  SRT_NETX_VIC_IRQ_STAT_com3,                 /* External communication channel 3 */
  22,                                          /* Priority 22 */
  RX_INTERRUPT_MODE_SYSTEM,                   /* Allow interrupt to be a thread */
  RX_INTERRUPT_EOI_AUTO,                      /* EOI self by RX */
  RX_INTERRUPT_TRIGGER_RISING_EDGE,           /* Edge triggered */
  RX_INTERRUPT_PRIORITY_STANDARD,             /* Normal Priority */
  RX_INTERRUPT_REENTRANCY_DISABLED,           /* Interrupt itself is not reentrant */
},

/* Interrupt for RT&IRT scheduler */

/* System Time Compare interrupt */
{{PNS_RTC_SCHED_IRQ_NAME,RX_PERIPHERAL_TYPE_INTERRUPT,0},
  SRT_NETX_VIC_IRQ_STAT_systime_ns,           /* Use GPIO System Time Compare */
  16,                                          /* Priority 16 */
  RX_INTERRUPT_MODE_SYSTEM,                   /* Interrupt mode */
  RX_INTERRUPT_EOI_AUTO,                      /* EOI self by RX */
  RX_INTERRUPT_TRIGGER_RISING_EDGE,           /* Edge triggered */
  RX_INTERRUPT_PRIORITY_STANDARD,             /* Normal Priority */
  RX_INTERRUPT_REENTRANCY_DISABLED,           /* Interrupt itself is not reentrant */
},

/* ... */
};

```

The new switch (XC code) requires adaptation of the parameters of the EDD driver.

There are now three tasks implemented to handle the different frame priorities. This increases robustness regarding netload.

The following settings are recommended (when using netX100/500):

```

STATIC RX_EDD_PARAMETERS_T g_atEddParam[] = {
    { RX_EDD_PARAM_PHY_NAME,          PNS_PHY0_NAME,          0 },
    { RX_EDD_PARAM_PHY1_NAME,         PNS_PHY1_NAME,          1 },

    { RX_EDD_PARAM_XPEC_NAME,          "PNS_XPEC",           0 },
    { RX_EDD_PARAM_XMAC_RPU_NAME,      "PNS_XMACRPU",        0 },
    { RX_EDD_PARAM_XMAC_TPU_NAME,      "PNS_XMACTPU",        0 },
    { RX_EDD_PARAM_INTERRUPT_NAME,     "PNS_COM",            0 },
    { RX_EDD_PARAM_MS_INTERRUPT0_NAME, "PNS_MSINC",          0 },
    { RX_EDD_PARAM_FIFO_NAME,          "PNS_FIFO",           0 },

    { RX_EDD_PARAM_XPEC1_NAME,         "PNS_XPEC",           1 },
    { RX_EDD_PARAM_XMAC1_RPU_NAME,     "PNS_XMACRPU",        1 },
    { RX_EDD_PARAM_XMAC1_TPU_NAME,     "PNS_XMACTPU",        1 },
    { RX_EDD_PARAM_INTERRUPT1_NAME,    "PNS_COM",            1 },
    { RX_EDD_PARAM_MS_INTERRUPT1_NAME, "PNS_MSINC",          1 },
    { RX_EDD_PARAM_FIFO1_NAME,         "PNS_FIFO",           1 },

    { RX_EDD_PARAM_XPEC3_NAME,         "PNS_XPEC",           3 },
    { RX_EDD_PARAM_XMAC3_RPU_NAME,     "PNS_XMACRPU",        3 },
    { RX_EDD_PARAM_XMAC3_TPU_NAME,     "PNS_XMACTPU",        3 },
    { RX_EDD_PARAM_INTERRUPT3_NAME,    "PNS_COM",            3 },
    { RX_EDD_PARAM_MS_INTERRUPT3_NAME, "PNS_MSINC",          3 },
    { RX_EDD_PARAM_FIFO3_NAME,         "PNS_FIFO",           3 },

    { RX_PND_EDD_PARAM_NRT_TASK_NAME,  "PND_HAL_NRT",        0 },
    { RX_PND_EDD_PARAM_NRT_TASK_PRIO,  (void*)TSK_PRIO_11,   0 },
    { RX_PND_EDD_PARAM_NRT_TASK_TOK,   (void*)TSK_TOK_11,    0 },

    { RX_PND_EDD_PARAM_NWC_TASK_NAME,  "PND_HAL_NWC",        0 },
    { RX_PND_EDD_PARAM_NWC_TASK_PRIO,  (void*)TSK_PRIO_7,    0 },
    { RX_PND_EDD_PARAM_NWC_TASK_TOK,   (void*)TSK_TOK_7,     0 },

    { RX_PND_EDD_PARAM_RT_TASK_NAME,   "PND_HAL_RT",         0 },
    { RX_PND_EDD_PARAM_RT_TASK_PRIO,   (void*)TSK_PRIO_3,    0 },
    { RX_PND_EDD_PARAM_RT_TASK_TOK,    (void*)TSK_TOK_3,     0 },

    { RX_EDD_PARAM_END_OF_LIST } };

```

The PROFINET IO-Device stack V3.5 and higher needs more TLR_TIMERS than V3.4:

```

STATIC CONST TLR_TIMER_STARTUPPARAMETER_T g_tTlrTimerPrm =
{
    TLR_TASK_TIMER,          /* ulTaskIdentifier (TLR_TASK_PARAMETERHEADER) */
    1,                       /* ulParamVersion  (TLR_TASK_PARAMETERHEADER) */
    100,                     /* application timer resources (needs more than 20) */
    2,                       /* interrupt timer resources */
    2                         /* retry packet resources */
};

```

If the shared memory API is used, the PNS_AP task shall be added to the static tasks list as follows:

```
PNS_AP_DPM_STARTUPPARAMETER_V5_T g_tPnsApStartupPrm =
{
    TLR_TASK_PNIO_APDEV,
    PNS_AP_DPM_STARTUPPARAMETER_VERSION_5,
    0, /* Instance */
    PNS_AP_DPM_STARTUP_FLAG_USE_IRT, /* flags */
    8, /* MinDeviceInterval for netX100 */
    2, /* Ethernet Port number */
    0, /* DPM Channel Number */
    PNS_EDD_IDENTIFY_NAME,
    NULL,
    NULL,
    PNS_RTC_SCHED_IRQ_NAME, /* Name of the RT&IRT scheduler irq */
    NULL,
    NULL,
    "PNS_SF", /* SF LED */
    "PNS_BF", /* BF LED */
    "PNS_SF", /* Blink LED */
    NULL, /* flash parameters */
    0, /* EDD Instance */
    0, /* MSync0 IRQ Instance */
    1, /* MSync1 IRQ Instance */
    0, /* RT Scheduler IRQ Instance */
    0, /* Sync IRQ Instance */
    0, /* SF LED Instance */
    0, /* BF LED Instance */
    0, /* Blink LED Instance */
    NULL, /* FODMI task init-parameters */
    .tTaskRtc = {NULL, "PNIO_RTC", TSK_PRIO_4},
    .tTaskRta = {NULL, "PNIO_RTA", TSK_PRIO_14},
    .tTaskLldp = {NULL, "LLDP-Task", TSK_PRIO_13},
    .tTaskCmdev = {NULL, "PNIO_CMDEV", TSK_PRIO_18},
    .tTaskPnsif = {NULL, "PNS_IF", TSK_PRIO_21},
    .tTaskRpc = {NULL, "RPC", TSK_PRIO_16},
    .tTaskMibDB = {NULL, "Mib-Database", TSK_PRIO_31},
    .tTaskSnmp = {NULL, "SNMP-Server", TSK_PRIO_32},
    .tTaskFodmi = {NULL, "FODMI", TSK_PRIO_51},

    0x011E, /* Hilscher VendorID */
    0x0103, /* Hilscher cifX DeviceID */

    0, /* fiber optic Mautype port 0, only use if the Hardware has fiber optic */
    0, /* fiber optic Mautype port 1, only use if the Hardware has fiber optic */

    .patPNSModules = NULL,
};

RX_STATIC_TASK_T g_atStaticTasks[] = {
    /* ... */
    {"PNS_AP", /* Set Identification */
     TSK_PRIO_22, TSK_TOK_22, /* Set Priority, and Token ID */
     0, /* Set Instance to 0 */
     0, /* Pointer to Stack */
     1024, /* Size of Task Stack */
     0, /* Threshold to maximum possible value */
     RX_TASK_AUTO_START, /* Start task automatically */
     (void FAR*)TaskEnter_PnsAp, /* Task function to schedule */
     NULL, /* Function called when Task will be
deleted */
     (UINT32)&g_tPnsApStartupPrm, /* Startup Parameter */
     {0,0,0,0,0,0,0,0} /* Reserved Region */
    },
    /* ... */
};
```

This increases robustness regarding netload the TCP_UDP task should have a priority lower than PNS_AP task:

```

RX_STATIC_TASK_T g_atStaticTasks[] = {
    /* ... */

    /* TPC IP */
    { "TCP_UDP",
      TSK_PRIO_30, TSK_TOK_30,
      0,
      0,
      1024,
      0,
      RX_TASK_AUTO_START,
      (void FAR*)TaskEnter_TcpipTcpTask,
      NULL,
      deleted */
      (UINT32)&g_tTcpIpPrm,
      {0,0,0,0,0,0,0,0}
    },
    /* ... */
};

```

If the application uses the packet interface with the stack, the application is responsible for starting the stack. Therefore, the initialization sequence of the application shall be extended as follows:

```
TLR_HANDLE                hQuePnsIf; /* PNS-IF Task Queue */
PROFINET_IODEVICE_TASK_RESOURCES_T *ptPNSRsc /* Pointer to PNS Resources */

{ /* Start The stack */
    PROFINET_IODEVICE_STARTUPPARAMETER_T tPNSParam /* PNS Stack Parameters */

    tPNSParam.pszEddName          = PNS_EDD_IDENTIFY_NAME;
    tPNSParam.pszHwTimRTSchedName = NULL;
    tPNSParam.pszIrqMSync0Name    = NULL;
    tPNSParam.pszIrqMSync1Name    = NULL;
    tPNSParam.pszIrqRTSchedName   = PNS_RTC_SCHED_IRQ_NAME,;
    tPNSParam.pszIrqSyncApplName  = NULL;
    tPNSParam.ulEthPortCnt        = 2;
    tPNSParam.ulMaxAr             = 2;
    tPNSParam.ulFlags             =
        PROFINET_IODEVICE_STARTUP_FLAG_USE_IRT;
    tPNSParam.ulInstance          = 0;

    /* configure the priorities of all tasks */
    tPNSParam.tTaskRtc    = {NULL, "PNIO_RTC",      TSK_PRIO_4},
    tPNSParam.tTaskRta    = {NULL, "PNIO_RTA",      TSK_PRIO_14},
    tPNSParam.tTaskLldp   = {NULL, "LLDP-Task",     TSK_PRIO_13},
    tPNSParam.tTaskCmdev   = {NULL, "PNIO_CMDEV",    TSK_PRIO_18},
    tPNSParam.tTaskPnsif   = {NULL, "PNS_IF",       TSK_PRIO_21},
    tPNSParam.tTaskRpc     = {NULL, "RPC",          TSK_PRIO_16},
    tPNSParam.tTaskMibDB   = {NULL, "Mib-Database",  TSK_PRIO_31},
    tPNSParam.tTaskSnmp    = {NULL, "SNMP-Server",   TSK_PRIO_32},

    /* now start the stack */
    If (TLR_S_OK == PNS_StackInit(&tPNSParam, &ptPNSRsc))
    {
        hQuePnsIf = ptPNSRsc->hQuePnsif;
    }
}
```

Note: The handle `hQuePnsIf` is the handle to the message queue of the protocol stack.

6 Appendix

6.1 List of tables

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