



# Impact of IEC 61850 Edition 2 on the Object Modeling of Complex Multifunctional Protection IEDs

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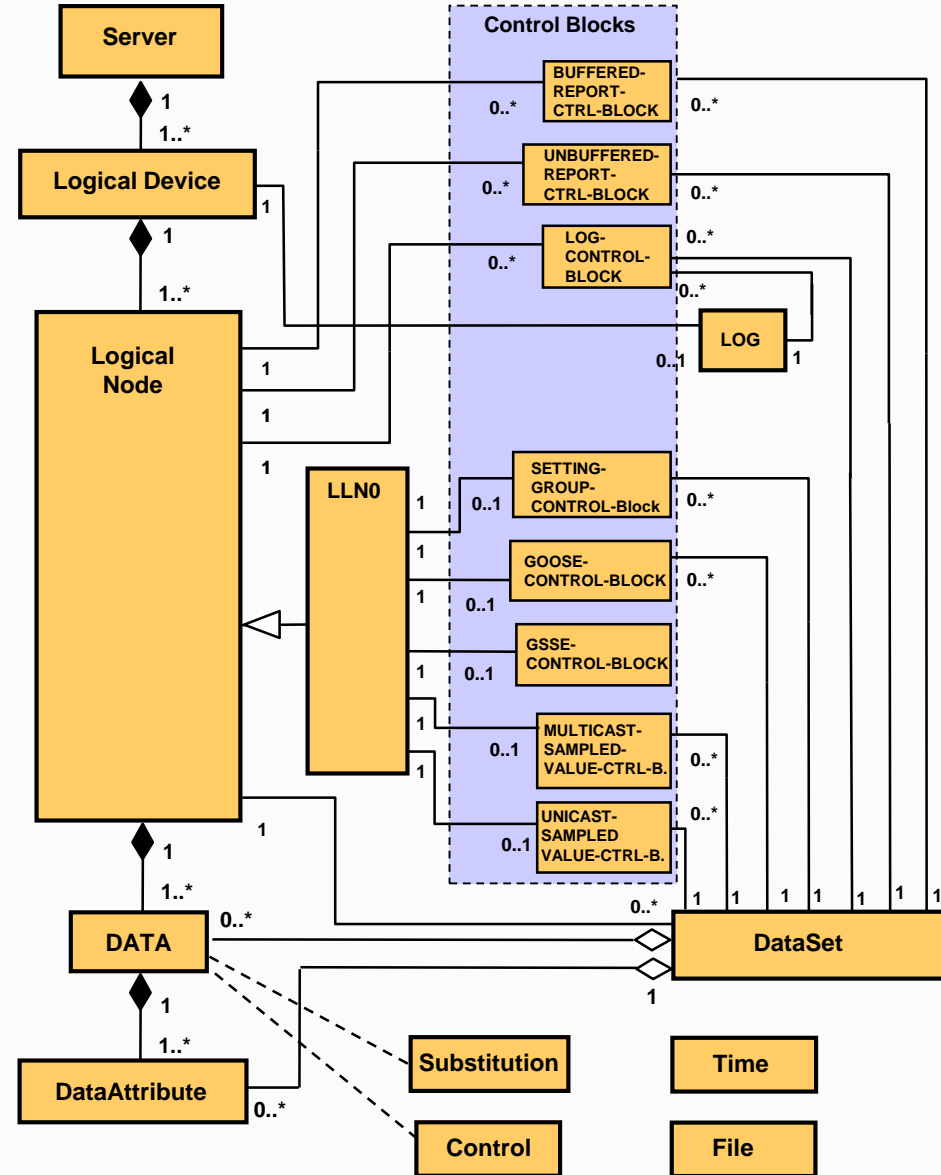
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Texas A&M, Texas, US

# Questions

- What are we doing?
- Why are we doing it?
- How are we doing it?

# IEC 61850 Services



# LN groups

Group indicator	Logical node groups
A	Automatic control
B	Reserved
C	Supervisory control
D	Distributed energy resources
E	Reserved
F	Functional blocks
G	Generic function references
H	Hydro power
I	Interfacing and archiving
J	Reserved
K <sup>a</sup>	Mechanical and non-electrical primary equipment
L	System logical nodes
M	Metering and measurement
N	Reserved
O	Reserved
P	Protection functions
Q	Power quality events detection related
R	Protection related functions
S	Supervision and monitoring
T <sup>a</sup>	Instrument transformer and sensors
U	Reserved
V	Reserved
W	Wind power
X <sup>a</sup>	Switchgear
Y <sup>a</sup>	Power transformer and related functions
Z <sup>a</sup>	Further (power system) equipment

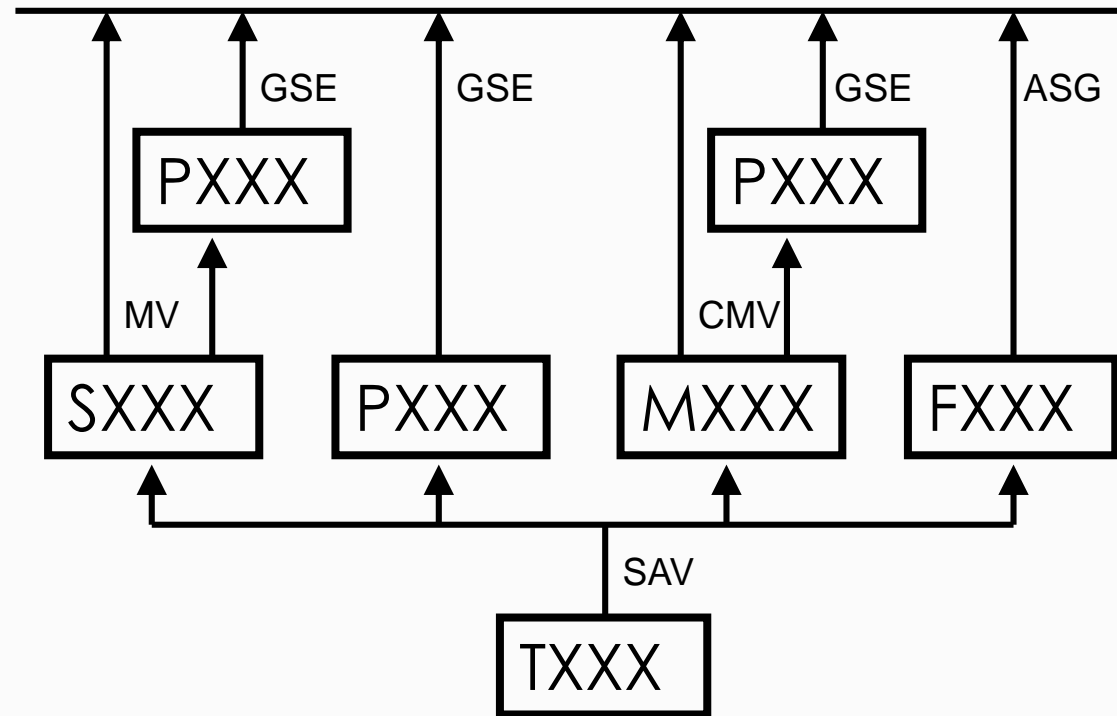
# New LNs in IEC 61850, 61400-25

ANCR	MSQI	PTUV	YPSH	ANCR	DPST	GAPC	ISAF	MMDC	PTEF	RDRS	TLEV	WTOW	ZREA
ARCO	MSTA	PUPF	YPTR	ARCO	DPVA	GGIO	ITCI	MMET	PTHF	RFLO	TLVL	WTRF	ZRES
ATCC	PDIF	PVOC	ZAXN	ARIS	DPVC	GLOG	ITMI	MMTN	PTOC	RMXU	TMGF	WTRM	ZRRC
AVCO	PDIR	PVPH	ZBAT	ATCC	DPVM	GSAL	ITPC	MMTR	PTOF	RPSB	TMVM	WTUR	ZSAR
CALH	PDIS	PZSU	ZBSH	AVCO	DRAT	HBRG	KFAN	MMXN	PTOV	RREC	TPOS	WYAW	ZSCR
CCGR	PDOP	RADR	ZCAB	CALH	DRAZ	HCOM	KFIL	MMXU	PTRC	RSYN	TPRS	XCBR	ZSMC
CILO	PDUP	RBDR	ZCAP	CCGR	DRCC	HDAM	KPMP	MPRS	PTTR	SARC	TRTN	XFUS	ZTCF
CLN	PFRC	RBRF	ZCON	CILO	DRCS	HDLS	KTNK	MSQI	PTUC	SCBR	TSND	XSWI	ZTCR
CPOW	PHAR	RDIR	ZGEN	CPOW	DRCT	HGPI	KVLV	MSTA	PTUF	SIMG	TTMP	YEFN	
CSWI	PHIZ	RDRE	ZGIL	CSWI	DREX	HGTE	LCCH	PDIF	PTUV	SIML	TTNS	YLTC	
GAPC	PIOC	RDRS	ZLIN	CSYN	DSCC	HITG	LGOS	PDIR	PUPF	SLTC	TVBR	YPSH	
GGIO	PMOC	RFPS	ZMOT	DCCT	DSCH	HJCL	LLNO	PMOC	PVPH	SOPM	TVTR	YPTR	
GSAL	PMOC	RFPS	ZREA	DCHB	DSFC	HLKG	LPHD	PTOC	PVPH	SPDC	TWPH	ZAXN	
IARC	POPF	RBRF	ZRRC	DCHC	DSTK	HLVL	LSVS	PTOV	PZSU	SPTR	WALG	ZBAT	
IHMI	PPAM	RSYN	ZSAR	DCIP	DTRC	HMBR	LTIM	PFRC	QFVR	SSWI	WALM	ZBSH	
ITCI	PSCH	SARC	ZTCF	DCRP	FCNT	HNDL	LTMS	PHAR	QITR	STMP	WAPC	ZBTC	
ITMI	PSDE	SIMG	ZTCR	DCTS	FCSD	HNHD	LTRK	PHIZ	QIUB	SVBR	WCNV	ZCAB	
LLNO	PTEF	SIML		DEXC	FFIL	HOTP	MENV	PIOC	QVTR	TANG	WCON	ZCAP	
LPHD	PTOC	SPDC		DFCL	FLIM	HRES	MFLK	PMRI	QVUB	TAXD	WGEN	ZCON	
MDIF	PTOF	TCTR		DFLV	FPID	HSEQ	MFLW	PMSS	QVVR	TCTR	WMET	ZGEN	
MHAI	PTOV	TVTR		DFPM	FRMP	HSPD	MFUL	POPF	RADR	TDST	WNAC	ZGIL	
MHAN	PTRC	XCBR		DGEN	FSEQ	HUNT	MHAI	PPAM	RBDR	TFLW	WREP	ZINV	
MMTR	PTTR	XSWI		DOPA	FSPT	HWCL	MHAN	PRTR	RBRF	TFRQ	WROT	ZLIN	
MMXN	PTUC	YEFN		DOPM	FXOT	IARC	MHET	PSCH	RDIR	TGSN	WRPC	ZMOT	
MMXU	PTUF	YLTC		DOPR	FXUT	IHMI	MHYD	PSDE	RDRE	THUM	WSLG	ZRCT	

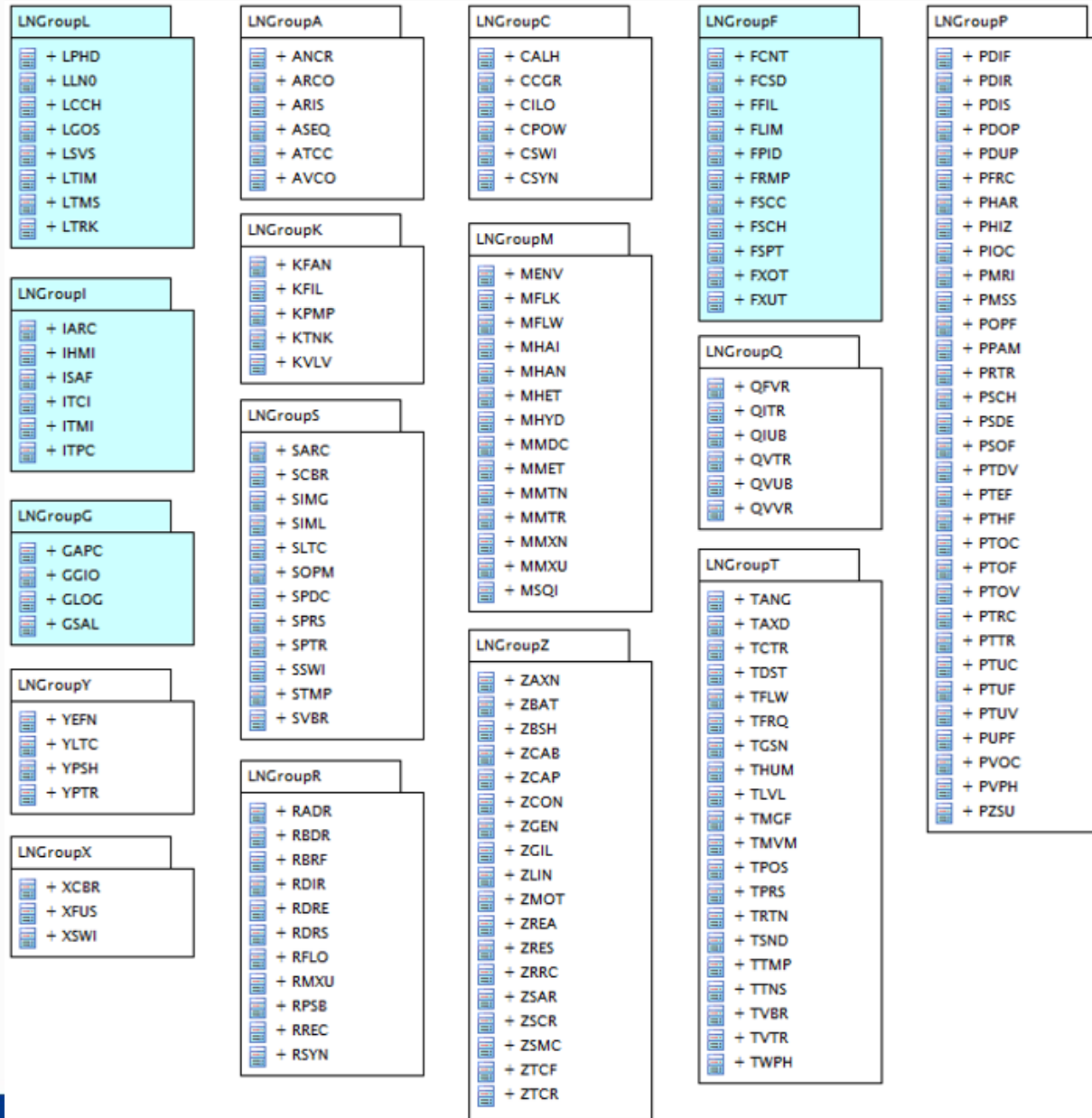
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# Functions Decomposition



# Class diagram LNs::LN Groups



# Sensors LNs

- Angle sensor Name: TANG
- Axial displacement sensor Name: TAXD
- Current transformer Name: **TCTR**
- Distance sensor Name: TDST
- Liquid flow sensor Name: TFLW
- Frequency sensor Name: TFRQ
- Generic sensor Name: TGSN
- Humidity sensor Name: **THUM**



# Sensors LNs

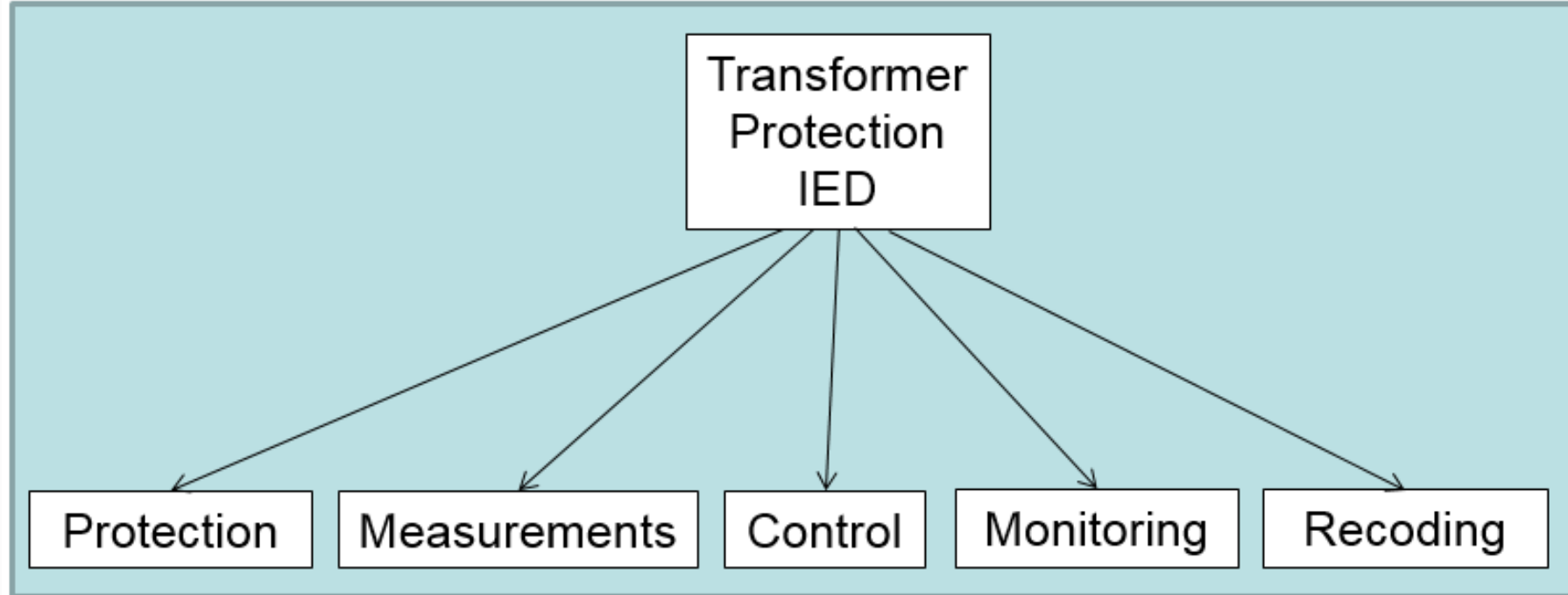
- Media level sensor Name: TLVL
- Magnetic field sensor Name: TMGF
- Movement sensor Name: TMVM
- Position indicator Name: **TPOS**
- Pressure sensor Name: **TPRS**
- Rotation transmitter Name: TRTN
- Sound pressure sensor Name: TSND

# Sensors LNs

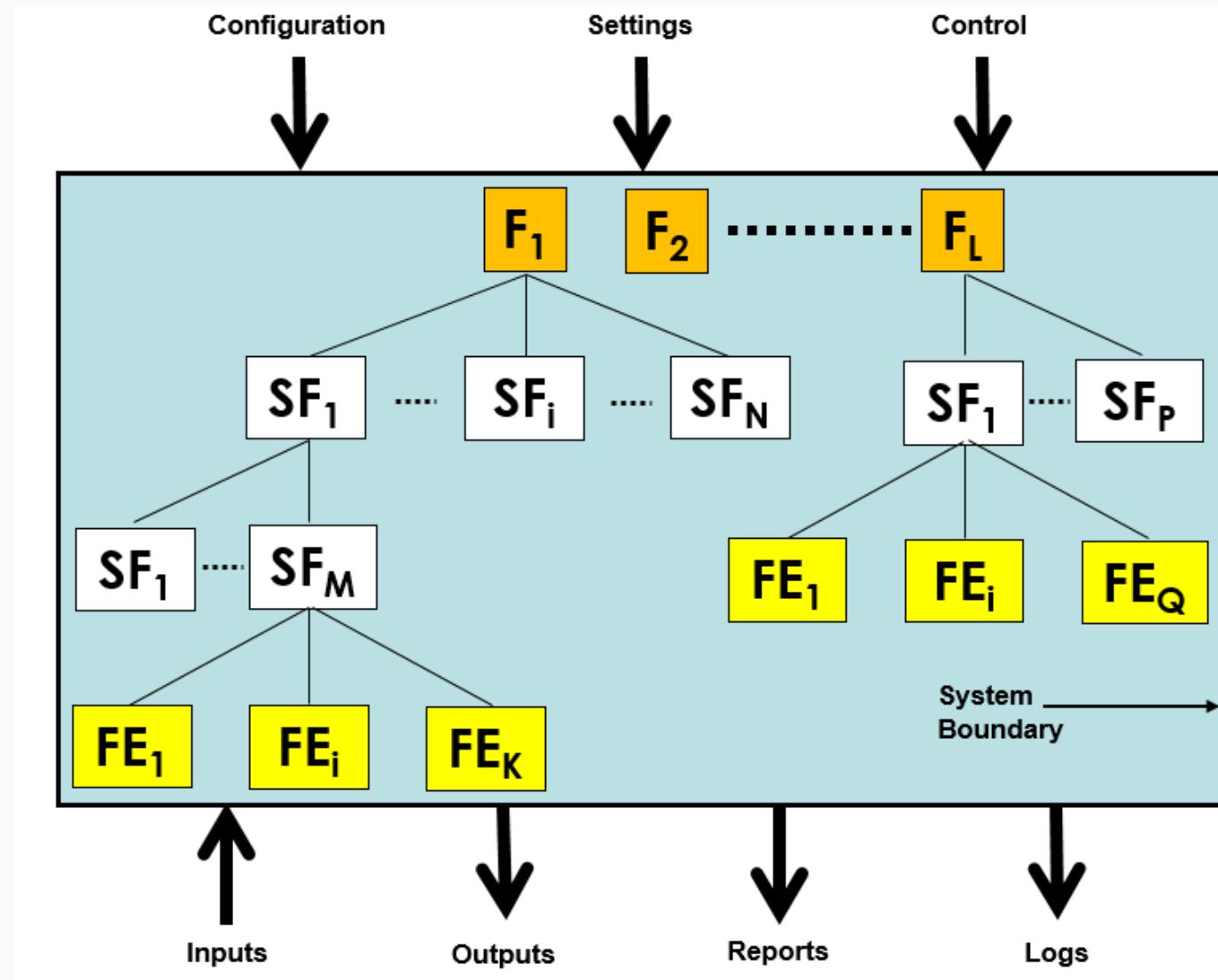
- Sound pressure sensor Name: TSND
- Temperature sensor Name: **TTMP**
- Mechanical tension / stress sensor Name: TTNS
- Vibration sensor Name: TVBR
- Voltage transformer Name: **TVTR**
- Water acidity sensor Name: TWPH

# Functions in a Protection IED

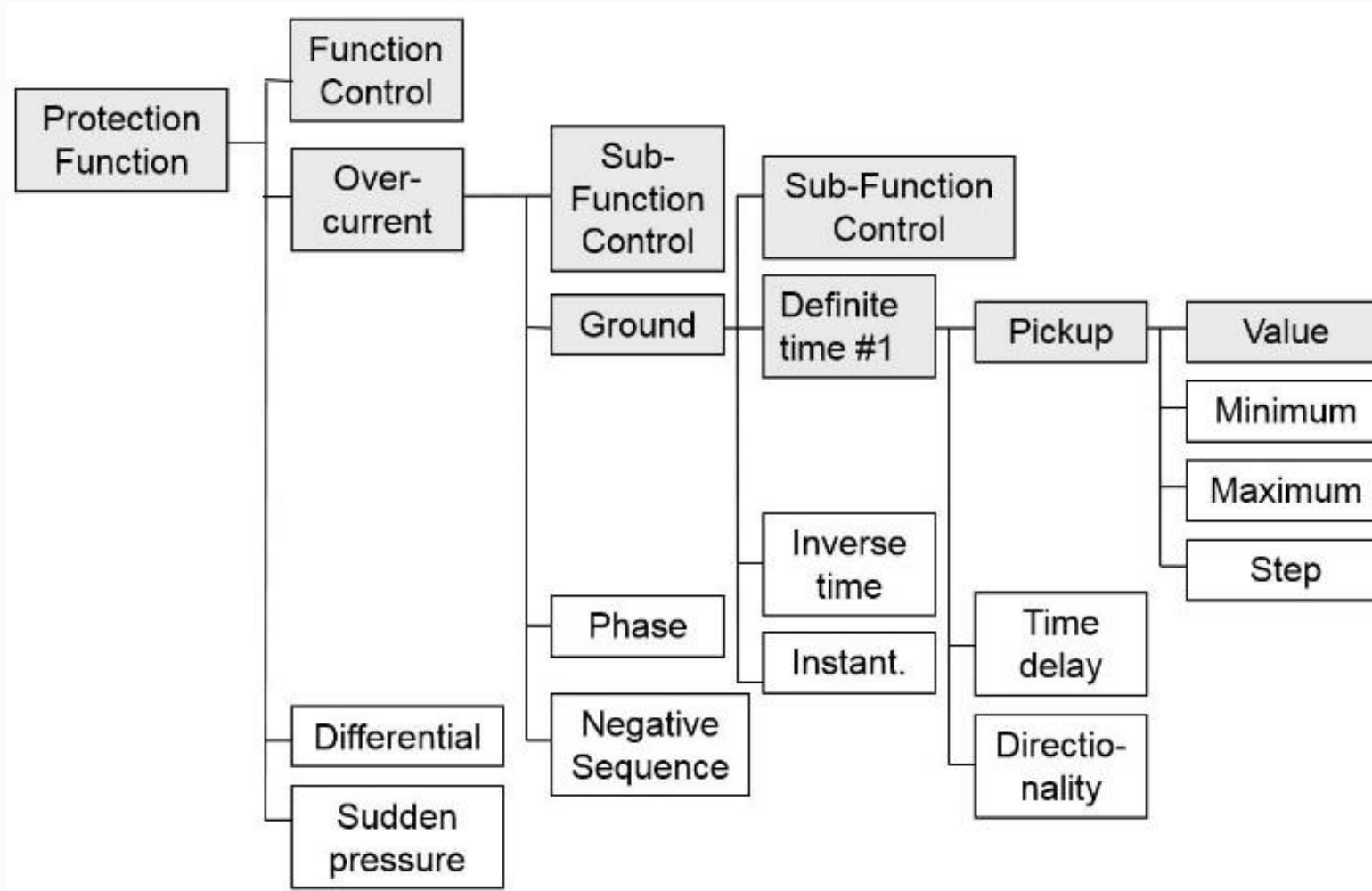
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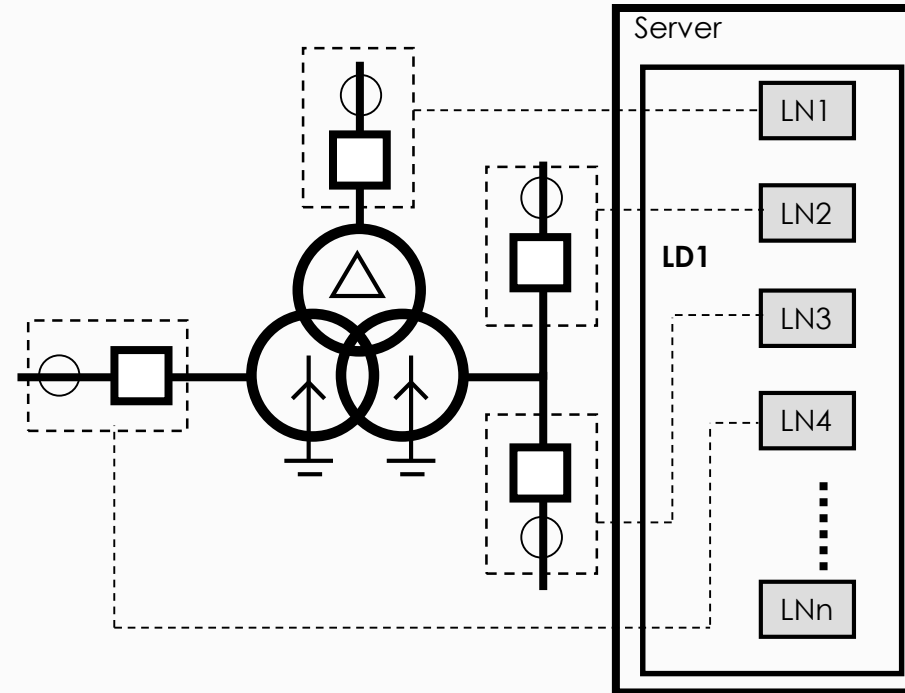
# Abstract Function Model Hierarchy



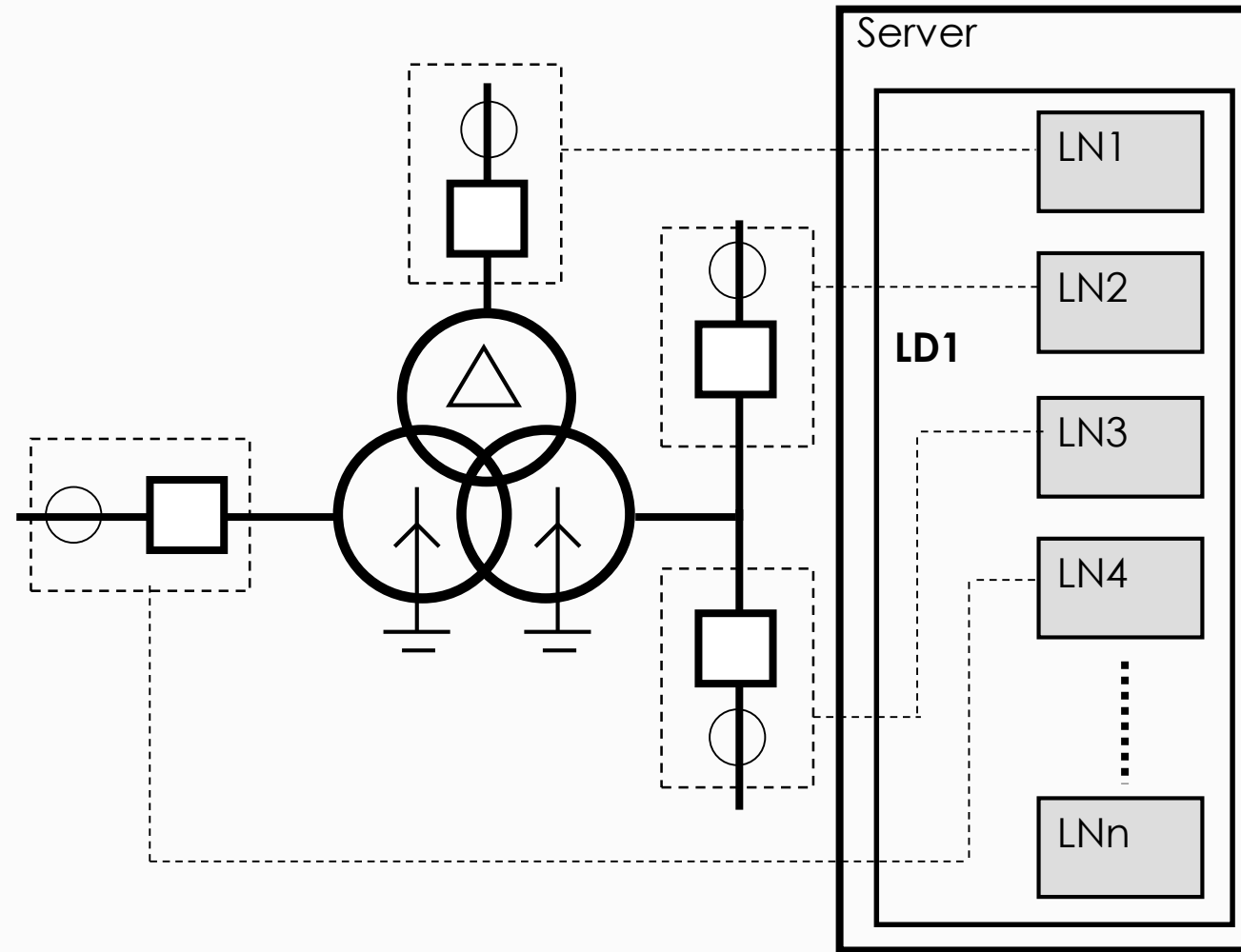
# Abstract functional hierarchy



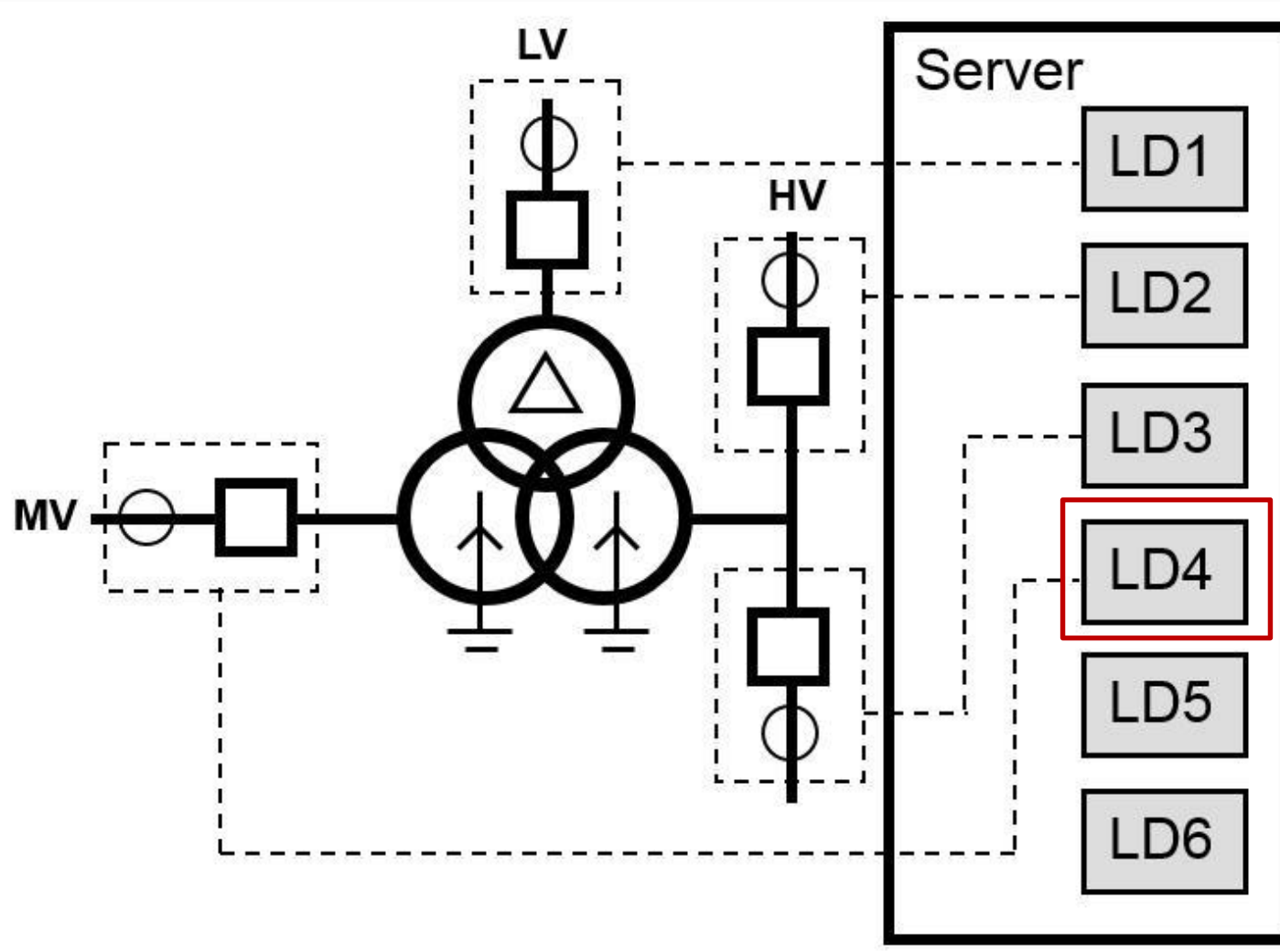
# Multifunctional IED Object Model



# Multifunctional IED Object Model

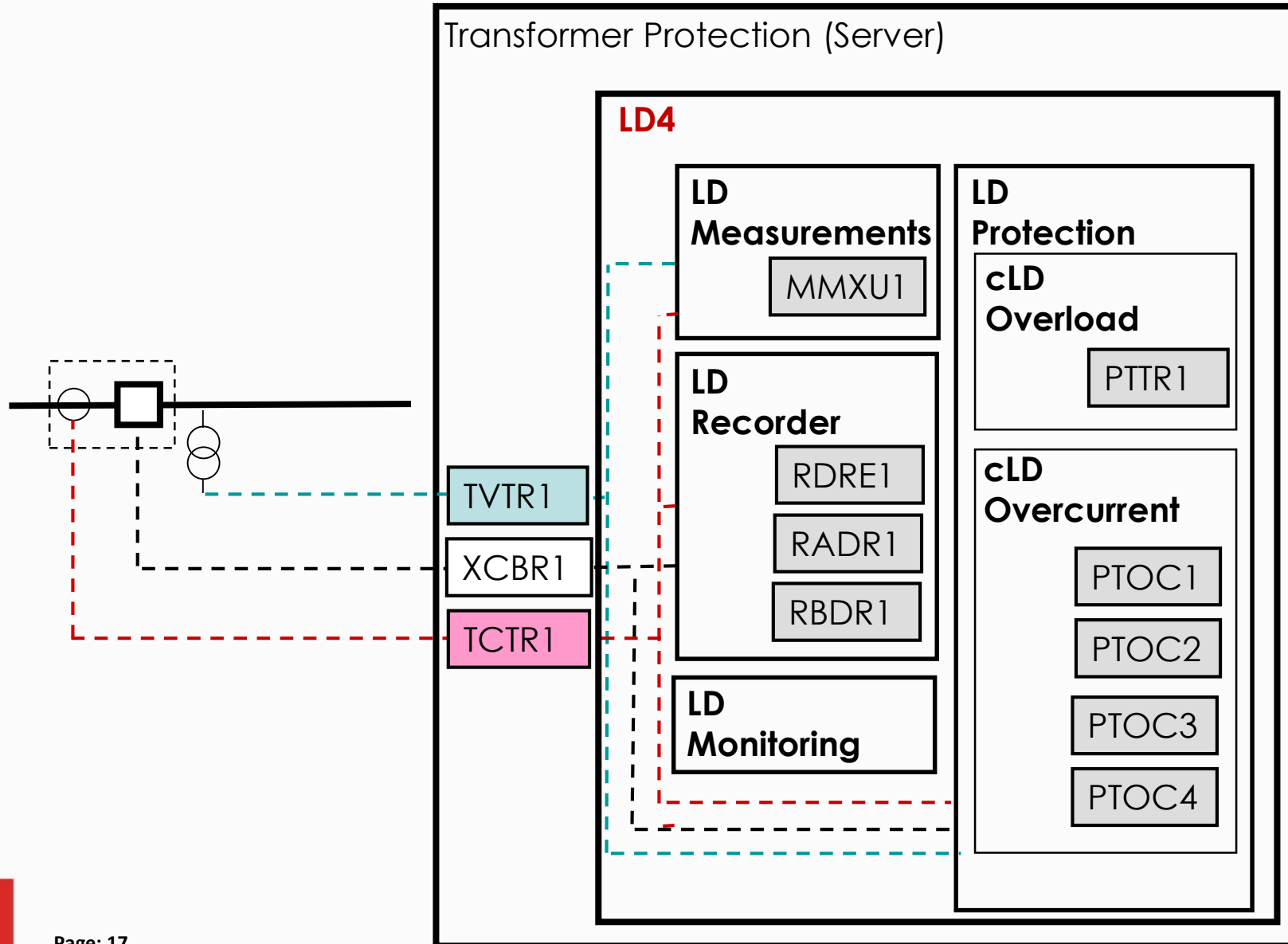


# Multifunctional IED Object Model

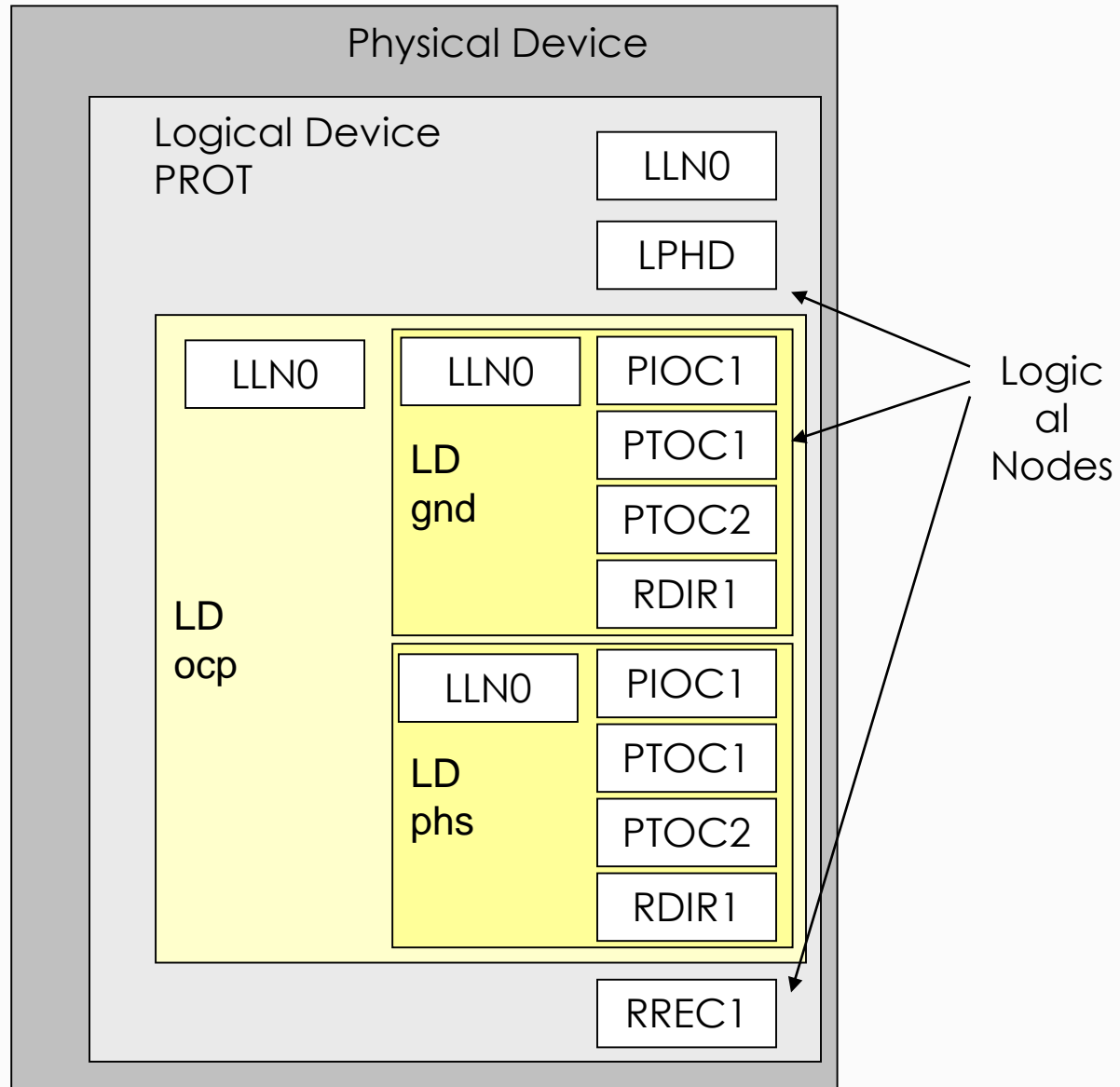




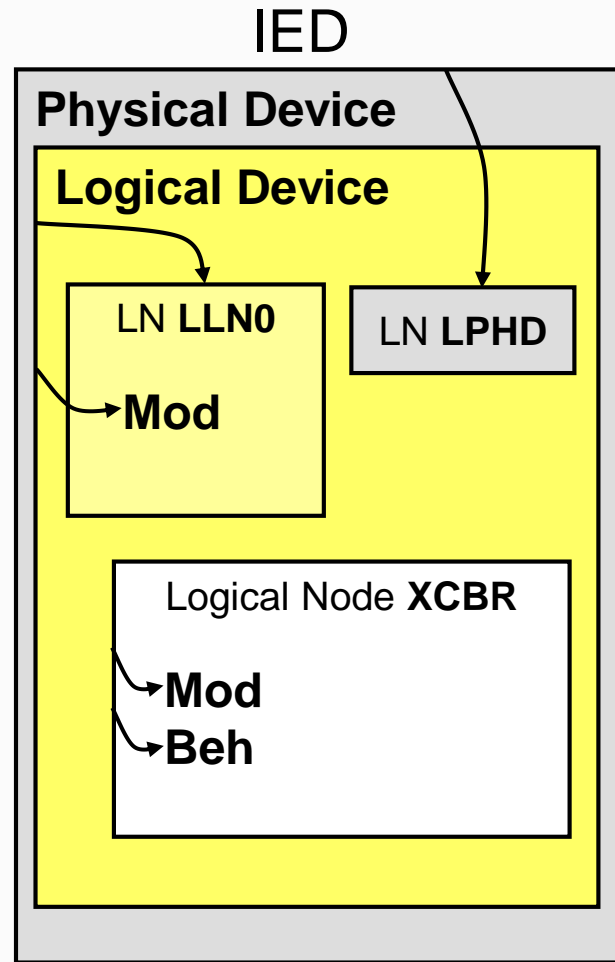
# LD Object Model



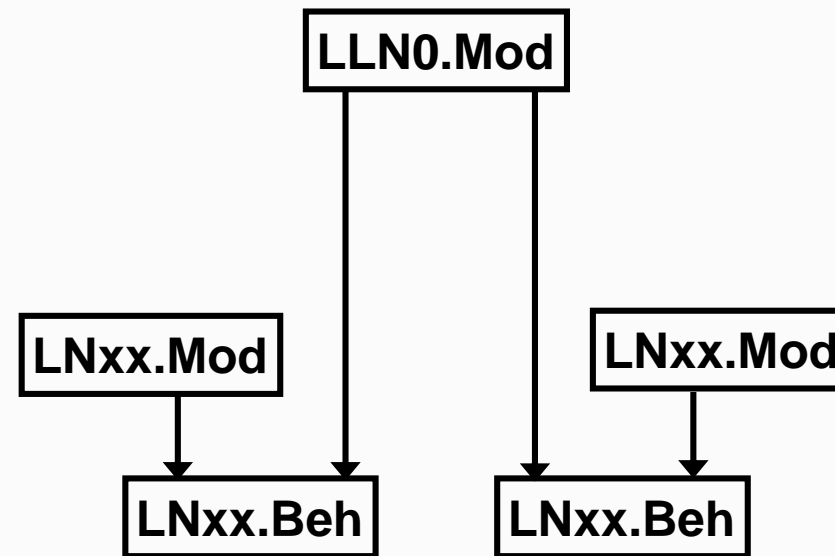
# Edition 2 – hierarchy of LDs



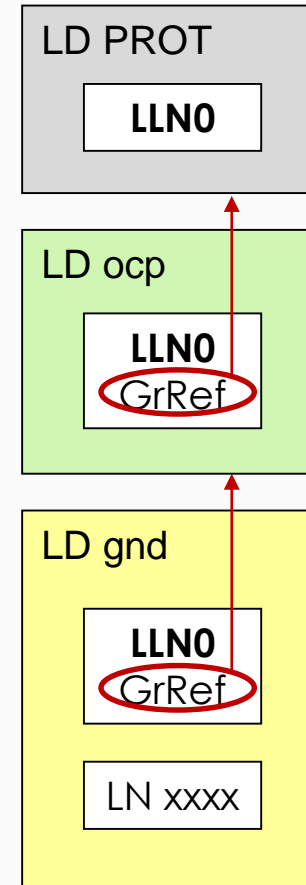
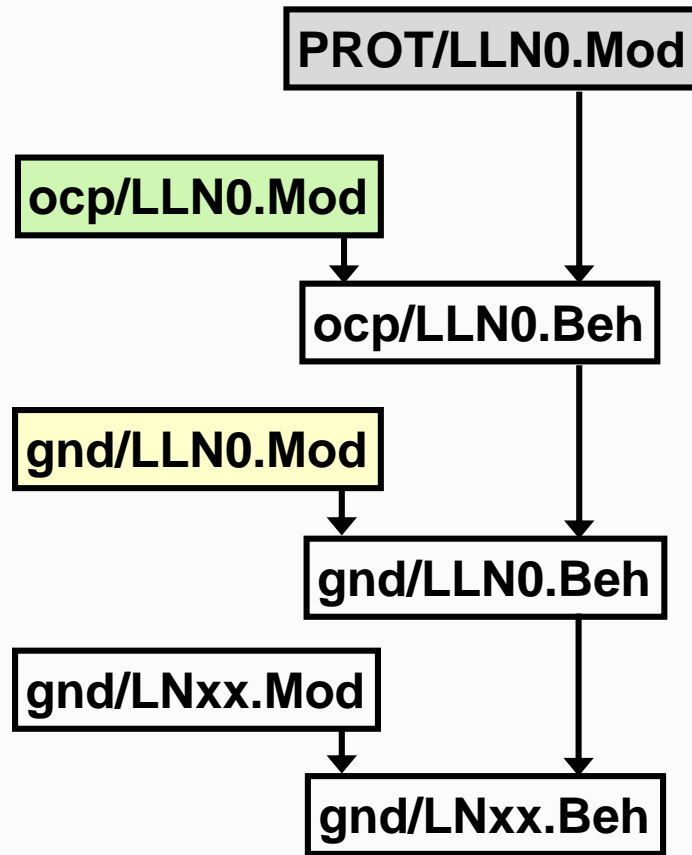
# LLN0 controls logical nodes



*Mod: on | blocked | test |  
test/blocked | off*



# Hierarchy of logical devices



# Conclusions

- The modeling of IEC 61850 based multifunctional transformer protection relays requires good understanding of their functional hierarchy, as well as the object modeling principles and their extensions in Edition 2 of the standard.
- Complex devices are modeled based on IEC 61850 Edition 2 as servers with multiple nested Logical Devices that correspond to typical substation functions, such as Protection, Control and Measurements.