

# **STANDAR**

## **PT PLN (PERSERO)**

**SPLN S4.008: 2021**

Lampiran Keputusan Direksi

PT PLN (Persero) No. 0098.K/DIR/2022

## **PENAMAAN DAN PENULISAN IEC 61850**



**PLN**

**PT PLN (PERSERO)**  
**Jl. Trunojoyo Blok M-1/135, Kebayoran Baru**  
**Jakarta Selatan 12160**



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**PT PLN (PERSERO)**  
**Jl. Trunojoyo Blok M-1/135, Kebayoran Baru**  
**Jakarta Selatan 12160**



# **PENAMAAN DAN PENULISAN IEC 61850**

**Disusun oleh:**

**Kelompok Bidang Standardisasi SCADA dan OPSIS  
dengan Keputusan  
Direksi PT PLN (Persero)  
No. 0164.K/DIR/2021**

**Kelompok Kerja Penamaan IEC 61850  
dengan Keputusan  
General Manager PT PLN (Persero) Puslitbang Ketenagalistrikan  
No. : 0012.K/GM-PUSLITBANG/2021**

**Diterbitkan oleh :  
PT PLN (PERSERO)  
JI. Trunojoyo Blok M - 1/135, Kebayoran Baru  
Jakarta Selatan 12160**



**PLN**

PT PLN (PERSERO)

## KEPUTUSAN DIREKSI PT PLN (PERSERO)

NOMOR: 0098 .K/DIR/2022

### TENTANG

#### PENETAPAN SPLN S4.008: 2021 PENAMAAN DAN PENULISAN IEC 61850

#### DIREKSI PT PLN (PERSERO)

- Menimbang :
- a. bahwa untuk memberikan pedoman yang terarah dan seragam dalam setiap perencanaan, pembangunan, operasi dan pemeliharaan Sistem Otomasi Gardu Induk (SOGI) dan peralatan/sistem yang menggunakan protokol IEC 61850, maka *Draft Standar Final (DSF)* SPLN S4.008: 2021 Penamaan dan Penulisan IEC 61850 yang disusun oleh Kelompok Bidang Standardisasi SCADA perlu ditetapkan menjadi SPLN;
  - b. Bawa *Draft Standar Final (DSF)* sebagaimana dimaksud pada huruf a telah memenuhi syarat untuk ditetapkan menjadi SPLN S4.008: 2021 Penamaan dan Penulisan IEC 61850.
  - c. bahwa berdasarkan pertimbangan sebagaimana dimaksud pada huruf a dan b, perlu menetapkan Keputusan Direksi PT PLN (Persero) tentang Penetapan SPLN S4.008: 2021 Penamaan dan Penulisan IEC 61850.
- Mengingat :
1. Undang-Undang Republik Indonesia Nomor 19 Tahun 2003 tentang Badan Usaha Milik Negara;
  2. Undang-Undang Republik Indonesia Nomor 40 Tahun 2007 tentang Perseroan Terbatas;
  3. Undang-Undang Republik Indonesia Nomor 30 Tahun 2009 tentang Ketenagalistrikan;
  4. Undang-Undang Republik Indonesia Nomor 11 Tahun 2020 tentang Cipta Kerja;
  5. Peraturan Pemerintah Republik Indonesia Nomor 23 Tahun 1994 tentang Pengalihan Bentuk Perusahaan Umum (Perum) Listrik Negara Menjadi Perusahaan Perseroan (Persero);
  6. Peraturan Pemerintah Republik Indonesia Nomor 45 Tahun 2005 tentang Pendirian, Pengurusan, Pengawasan dan Pembubaran Badan Usaha Milik Negara;

7. Peraturan ...

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**PLN**

7. Peraturan Pemerintah Republik Indonesia Nomor 14 Tahun 2012 tentang Kegiatan Usaha Penyediaan Tenaga Listrik sebagaimana telah diubah dengan Peraturan Pemerintah Republik Indonesia Nomor 23 Tahun 2014;
8. Peraturan Pemerintah Republik Indonesia Nomor 62 Tahun 2012 tentang Usaha Jasa Penunjang Tenaga Listrik;
9. Peraturan Pemerintah Republik Indonesia Nomor 25 Tahun 2021 tentang Penyelenggaraan Bidang Energi dan Sumber Daya Mineral;
10. Anggaran Dasar PT PLN (Persero);
11. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-138/MBU/07/2017 tentang Pemberhentian, Perubahan Nomenklatur Jabatan, Pengalihan Tugas, dan Pengangkatan Anggota-anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
12. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-325/MBU/12/2019 tentang Pemberhentian, Perubahan Nomenklatur dan Pengangkatan Anggota-anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
13. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-147/MBU/05/2020 tentang Pemberhentian, Perubahan Nomenklatur Jabatan, Pengalihan Tugas, dan Pengangkatan Anggota-anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
14. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-357/MBU/11/2020 tentang Pemberhentian dan Pengangkatan Anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
15. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-49/MBU/02/2021 tentang Perubahan Nomenklatur Jabatan dan Pengalihan Tugas Anggota-Anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;

16. Keputusan ...

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16. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-200/MBU/06/2021 tentang Pemberhentian, Pengalihan Tugas, dan Pengangkatan Anggota-anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
17. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-389/MBU/12/2021 tentang Pemberhentian, Perubahan Nomenklatur Jabatan, dan Pengalihan Tugas Anggota-Anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
18. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-392/MBU/12/2021 tentang Pemberhentian dan Pengangkatan Anggota-Anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
19. Keputusan Menteri Badan Usaha Milik Negara Selaku Rapat Umum Pemegang Saham Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara Nomor SK-2/MBU/01/2022 tentang Pemberhentian dan Pengangkatan Anggota Direksi Perusahaan Perseroan (Persero) PT Perusahaan Listrik Negara;
20. Keputusan Direksi PT PLN (Persero) Nomor 304.K/DIR/2009 tentang Batasan Kewenangan Pengambilan Keputusan di Lingkungan PT PLN (Persero) sebagaimana telah beberapa kali diubah, terakhir dengan Peraturan Direksi PT PLN (Persero) Nomor 0297.P/DIR/2016;
21. Peraturan Direksi PT PLN (Persero) Nomor 0162.P/DIR/2021 tentang Organisasi dan Tata Kerja PT PLN (Persero);
22. Keputusan Direksi PT PLN (Persero) Nomor 033.K/DIR/2005 tentang Penetapan PT PLN (Persero) Penelitian dan Pengembangan Ketenagalistrikan sebagai Penanggung Jawab Kegiatan Standardisasi di Lingkungan PT PLN (Persero);
23. Keputusan Direksi PT PLN (Persero) Nomor 0164.K/DIR/2021 tentang Pembentukan Kelompok Bidang Standardisasi Ketenagalistrikan di Lingkungan PT PLN (Persero).

Memperhatikan : Surat Kuasa Direktur Utama PT PLN (Persero) kepada Direktur Perencanaan Korporat PT PLN (Persero) Nomor 0312.Sku/LIT.03.01/C01000000/2021 tanggal 24 Juni 2021 terkait penandatanganan Keputusan Direksi PT PLN (Persero) tentang Penetapan Standar PT PLN (Persero) (SPLN).

MEMUTUSKAN ...

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- Menetapkan : KEPUTUSAN DIREKSI PT PLN (PERSERO) TENTANG PENETAPAN SPLN S4.008: 2021 PENAMAAN DAN PENULISAN IEC 61850.
- PERTAMA : Menetapkan SPLN S4.008: 2021 Penamaan dan Penulisan IEC 61850 sebagaimana tercantum dalam Lampiran Keputusan ini.
- KEDUA : SPLN S4.008: 2021 sebagaimana dimaksud dalam Diktum PERTAMA diberlakukan di lingkungan PT PLN (Persero) dan Anak Perusahaan PT PLN (Persero) melalui adopsi secara langsung oleh Direksi Anak Perusahaan atau pengukuhan dalam Rapat Umum Pemegang Saham (RUPS) Anak Perusahaan PT PLN (Persero) atau melalui ratifikasi.
- KETIGA : Pada saat Keputusan ini mulai berlaku, ketentuan-ketentuan lain yang bertentangan dengan Keputusan ini dicabut dan dinyatakan tidak berlaku.

Keputusan ini mulai berlaku sejak tanggal diterbitkan.

Ditetapkan di Jakarta  
pada tanggal 29 Maret 2022

DIREKTUR  
PERENCANAAN KORPORAT,



E. HARYADI

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## **Susunan Kelompok Bidang Standardisasi SCADA dan OPSIS**

**Keputusan Direksi PT PLN (Persero)**

No. 0164.K/DIR/2021

- |                                      |  |
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| 3. Riko Ramadhan B, S.T., M.T.       | : Sebagai Anggota                      |
| 4. Guntur Supriyadi, S.T., M.Sc.     | : Sebagai Anggota                      |
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| 8. M. Choliq Fadli, S.T., M.Sc.      | : Sebagai Anggota                      |
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| 10. Indra Utama Ichsan, S.T.         | : Sebagai Anggota                      |
| 11. Doni Adrean, S.T.                | : Sebagai Anggota                      |
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| 13. Dhany Harmeydy Barus, S.T., M.T. | : Sebagai Anggota                      |
| 14. Nurdin Pabi, S.T.                | : Sebagai Anggota                      |
| 15. Eko Wibowo, S.T., M.M.           | : Sebagai Anggota                      |
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## **Susunan Kelompok Kerja Standardisasi Penamaaan IEC 61850**

**Keputusan General Manager PT PLN (Persero) Puslitbang Ketenagalistrikan**

No. 0012.K/GM-PUSLITBANG/2021

- |                                    |  |
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| 3. Sriyono, S.T., M.T.             | : Sebagai Anggota                      |
| 4. R. Dimas Dityagraha, S.T., M.T. | : Sebagai Anggota                      |
| 5. Anang Hardoyo, S.Si.            | : Sebagai Anggota                      |
| 6. Syamsu Rijal, S.T.              | : Sebagai Anggota                      |
| 7. Gatot Sugiarto, S.T.            | : Sebagai Anggota                      |
| 8. Andi Putra Pradana, S.T.        | : Sebagai Anggota                      |
| 9. Danang Cahya Kartika, S.T.      | : Sebagai Anggota                      |

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## Prakata

Standar PLN S4.008 Penamaan dan Penulisan IEC 61850 merupakan penjelasan yang terperinci mengenai Penamaan dan Penulisan IEC 61850.

Standar ini mencakup penamaan *bay level* dan *station level*, IP Address, Penamaan Teleinformasi (*Logical Node*, *Data Object*, *Common Data Class*, *Data Attribute*, *Functional Constraint*) dan Format/Sintaks SCL dari IEC 61850 yang harus dipenuhi untuk *configuration process* pada Sistem Otomasi Gardu Induk (SOGI) dan peralatan/sistem yang menggunakan protokol IEC 61850.

Standar ini menjadi acuan dalam setiap perencanaan, pembangunan, operasi dan pemeliharaan Sistem Otomasi Gardu Induk (SOGI) dan peralatan/sistem yang menggunakan protokol IEC 61850 di PT PLN (Persero).

# Penamaan dan Penulisan IEC 61850

## 1 Ruang Lingkup

Standar ini dimaksudkan untuk menetapkan standar penamaan dan penulisan IEC 61850, yang berlaku pada Sistem Otomasi Gardu Induk (SOGI) dan peralatan/sistem yang menggunakan protokol IEC 61850, standar ini meliputi:

- a. Penamaan *Bay Level* dan *Station Level*;
- b. IP Address;
- c. Penamaan Teleinformasi (*Logical Node*, *Data Object*, *Common Data Class*, *Data Attribute*, *Functional Constraint*);
- d. Format/Sintaks SCL.

SPLN penamaan dan penulisan IEC 61850 ini mengacu pada IEC 61850 edisi 2.1.

## 2 Tujuan

Standar ini bertujuan untuk memberikan pedoman yang terarah dan seragam pada penamaan dan penulisan IEC 61850 yang digunakan di lingkungan PLN.

## 3 Acuan Normatif

Dokumen-dokumen berikut terkait dengan standar ini. Dalam hal terjadi perubahan pada dokumen tersebut, maka ketentuan dapat mengikuti edisi terakhir.

- a. SPLN S5.001-1: 2020 - *Teleinformasi Data untuk Operasi Jaringan Tenaga Listrik, Bagian 1: Sistem Penyaluran*;
- b. IEC TR 61850-1: 2013 - *Communication Networks and Systems for Power Utility Automation – Part 1: Introduction and Overview*;
- c. IEC TS 61850-2:2019 - *Communication Networks and Systems for Power Utility Automation – Part 2: Glossary*;
- d. IEC 61850-6:2009+AMD1:2018 CSV - *Communication Networks and Systems for Power Utility Automation - Part 6: Configuration Description Language for Communication in Power Utility Automation Systems Related to IEDs*;
- e. IEC 61850-7-2:2010+AMD1:2020 CSV - *Communication Networks and Systems for Power Utility Automation - Part 7-2: Basic Information and Communication Structure - Abstract Communication Service Interface (ACSI)*;
- f. IEC 61850-7-3:2010+AMD1:2020 CSV - *Communication Networks and Systems for Power Utility Automation - Part 7-3: Basic Communication Structure - Common Data Classes*;

- g. IEC 61850-7-4:2010+AMD1:2020 CSV - *Communication Networks and Systems for Power Utility Automation - Part 7-4: Basic Communication Structure - Compatible Logical Node Classes and Data Object Classes.*

## 4 Istilah dan Definisi

### 4.1 Definisi

- ***Bay level***

Tingkat konfigurasi pada standard IEC 61850 yang melingkupi IED BCU, IED Proteksi dan IED lainnya.

- ***Common Data Class (CDC)***

*Template* yang mengelompokkan semua *data attribute* yang mungkin yang merupakan bagian dari kelas objek data yang mewakili informasi yang terkait dengan status, pengukuran, kontrol, *setting*. [IEC TS 61850-2]

Contoh CDC: SPS (*Single Point Status*), DPS (*Double Point Status*), MV (*Measured Value*), SPC (*Controllable Single Point*), DPC (*Controllable Double Point*), APC (*Controllable Analogue set point information*) dan lain-lain. CDC didefinisikan dalam IEC 61850-7-3.

- ***Data Attribute (DA)***

Mendefinisikan nama, format, rentang nilai yang mungkin, dan representasi nilai saat dikomunikasikan. [IEC 61850-7-2]

Contoh *Data Attribute (DA)* : stVal (*Status Value of the data*), q (*quality*), t (*timestamp*) dan lain-lain. *Data Attribute (DA)* didefinisikan dalam IEC 61850-7-3.

- ***Data Object (DO)***

Bagian dari objek *logical node* yang mewakili informasi spesifik, misalnya, status atau pengukuran. Dari sudut pandang *object-oriented*, *Data Object (DO)* adalah turunan dari kelas *Data Object*. *Data object* biasanya digunakan dalam pertukaran data. *Data object* berupa struktur data. [IEC 61850-1]

Contoh *Data Object (DO)* : Op (*Operate*), Pos (*Position*), TapPos (*Tap Position*) dan lain-lain. *Data Object (DO)* didefinisikan dalam IEC 61850-7-4.

- **Functional Constraint (FC)**

Properti dari *Data Attribute* (DA) yang menunjukkan service misalnya *read value*, *write value*, *substitute value* dan lain-lain, yang dapat diterapkan ke *Data Attribute* (DA) tersebut. [IEC 61850-7-2]

Contoh *Functional Constraint* (FC) : ST (*Status information*), MX (*Measurands/analogue values*), CO (*Control*), SP (*Setpoint*) dan lain-lain. *Functional Constraint* (FC) didefinisikan dalam IEC 61850-7-3.

- **Gateway**

Simpul relai (*relay node*) jaringan data di mana jalur transmisi dengan definisi protokol yang berbeda dari semua tujuh *layer* protokol terinterkoneksi oleh konversi protokol.

- **Human Machine Interface (HMI)**

Perangkat di mana pengguna berinteraksi dengan suatu sistem. HMI menyediakan fasilitas di mana pengguna dapat memberikan input kepada sistem dan sistem dapat memberikan *output* kepada pengguna.

- **Logical Device (LD)**

Entitas yang mewakili suatu set otomasi, proteksi, atau fungsi lainnya. [IEC 61850-7-2]

- **Logical Node (LN)**

Bagian terkecil dari fungsi yang bertukar data. LN adalah objek yang ditentukan oleh data dan metodenya.

- **Physical device**

Entitas yang mewakili bagian fisik suatu *device* (perangkat keras dan sistem operasi, dan lain-lain) [IEC 61850-7-2]

- **Protokol**

Sekumpulan semantik dan aturan cara penulisan (sintaksis) yang menentukan cara unit fungsional dalam berkomunikasi. [ISO/IEC 2382-9]

- **Server**

Komputer yang berfungsi menyediakan layanan khusus kepada komputer lainnya.

- **Sistem Otomasi Gardu Induk (SOGI)**

Sistem untuk mengelola, mengendalikan dan proteksi sistem tenaga listrik. Hal ini dapat dicapai dengan mengambil informasi *real time* dari sistem, didukung oleh aplikasi *local* dan *remote control* yang handal dan proteksi sistem tenaga listrik. Terdiri dari *local intelligence*, komunikasi data dan *supervisory control*, serta *monitoring*.

- **System Configuration Description Language/Substation Configuration Language (SCL)**

Bahasa tingkat tinggi yang ditentukan sebagai skema XML untuk menjelaskan konfigurasi dan sistem komunikasi IED-IED pada otomasi *power utility* [IEC TS 61850-2].

- **Station level**

Tingkat konfigurasi pada standard IEC 61850 yang melingkupi server, workstation dan gateway.

- **Supervisory Control and Data Acquisition (SCADA)**

Sistem yang mengawasi dan mengendalikan peralatan proses yang tersebar secara geografis. [IEC 870-1-3]

- **Switch**

Terminal yang berfungsi untuk menghubungkan antar komputer dan komputer ke *peripheral* dalam satu LAN.

- **Tele Informasi Data (TID)**

TID yang digunakan pada SPLN ini adalah SPLN S5.001-1: 2020 - Teleinformasi Data Untuk Operasi Jaringan Tenaga Listrik, Bagian 1: Sistem Penyaluran.

## 4.2 Daftar Istilah

AGC	: <i>Automatic Generation Control</i>
CDC	: <i>Common Data Class</i>
DA	: <i>Data Attribute</i>
DO	: <i>Data Object</i>
FC	: <i>Functional Constraint</i>
GPS	: <i>Global Positioning System</i>
HMI	: <i>Human Machine Interface</i>
IED	: <i>Intelligent Electronic Device</i>

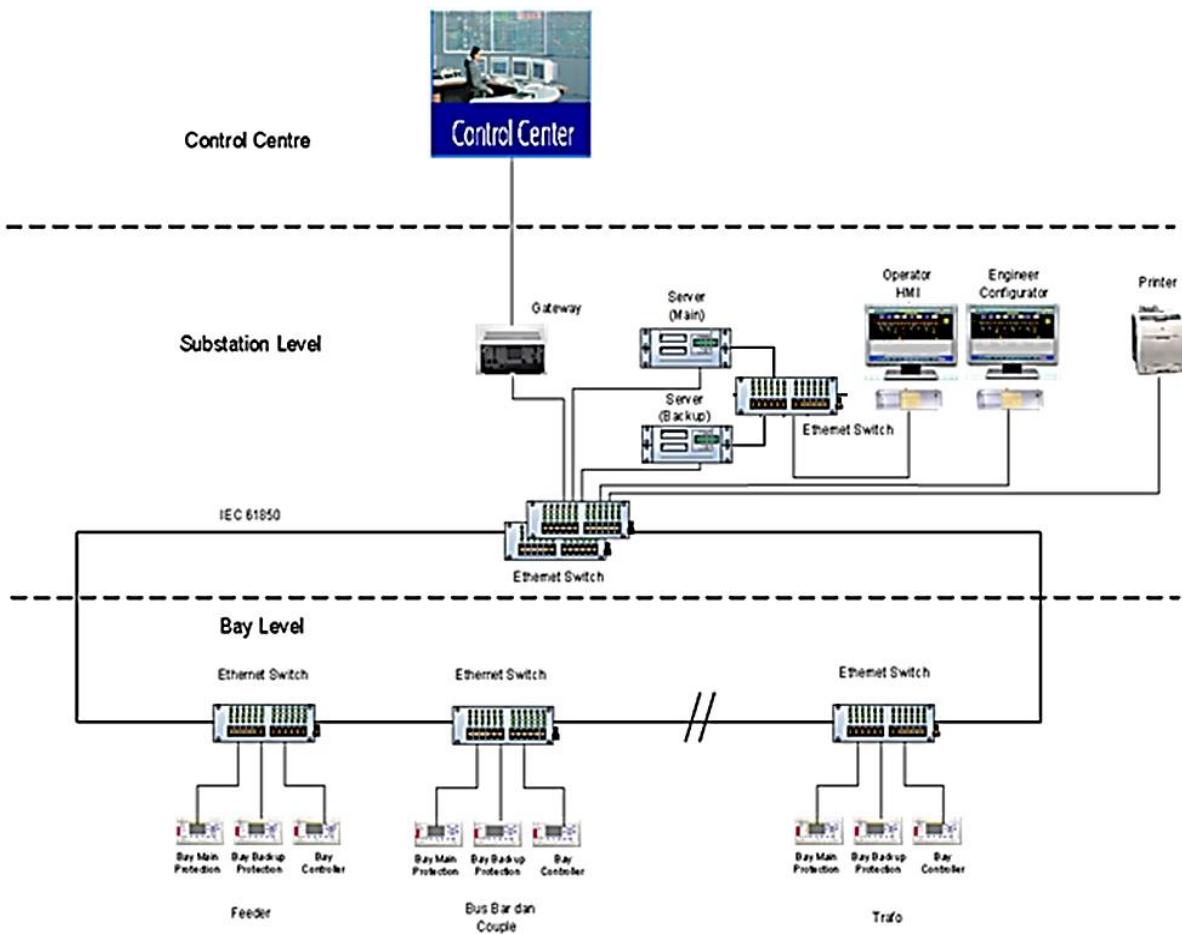
---

I/O	: <i>Input Output</i>
LFC	: <i>Load Frequency Control</i>
LD	: <i>Logical Device</i>
LN	: <i>Logical Node</i>
SCL	: <i>System Configuration description Language/Substation Configuration</i>
SOGI	: Sistem Otomasi Gardu Induk

## 5 Penamaan dan penulisan IEC 61850

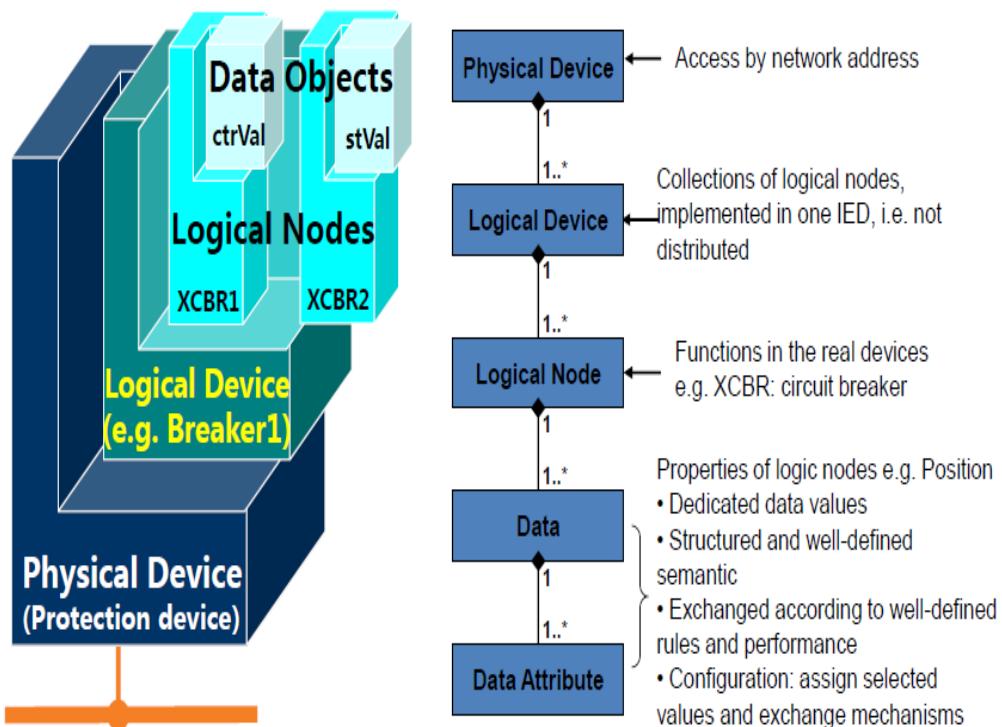
IEC 61850 merupakan protokol yang digunakan dalam pertukaran informasi antar peralatan dalam Sistem Otomasi Gardu Induk dan peralatan/sistem yang menggunakan protokol IEC 61850. Dalam menggunakan protokol IEC 61850 diperlukan standar penamaan dan penulisan, sehingga tidak ada perbedaan penamaan dan penulisan IEC 61850 dari semua pabrikan peralatan SOGI dan peralatan/sistem yang menggunakan protokol IEC 61850 di lingkungan PLN. Standarisasi penamaan dan penulisan IEC 61850 ini meliputi:

- a. Penamaan *bay level* dan *station level*;
- b. IP Address;
- c. Penamaan Teleinformasi (*Logical Node*, *Data Object*, *Common Data Class*, *Data Attribute*, *Functional Constraint*);
- d. Format/*sintaks* SCL.



Gambar 1 Contoh Arsitektur SOGI

Semua peralatan SOGI baik pada *bay level* (IED dan lain-lain) dan *station level* (server, workstation, gateway dan lain-lain) harus memiliki nama dan IP address yang unik. Nama dan IP address ini digunakan sebagai identitas dari masing-masing peralatan SOGI. Untuk penamaan peralatan SOGI di *bay level* dan *station level* maksimal 12 karakter, dan aturan penamaannya ada pada sub pasal 5.1. Sedangkan untuk penentuan IP address peralatan SOGI diatur pada sub pasal 5.2, IP Address.



Gambar 2 Pemodelan data pada IEC 61850

Setiap device memiliki teleinformasi (*Logical Node*, *Data Object*, *Common Data Class*, *Data Attribute*, *Functional Constraint*) yang berbeda-beda. Untuk penamaan *Logical Node*, *Data Object*, *Common Data Class*, *Data Attribute*, dan *Functional Constraint* pada SPLN ini mengacu pada IEC 61850 edisi 2.1, dimana penamaannya di bahas pada sub pasal 5.3, Penamaan teleinformasi.

## 5.1 Penamaan *bay level* dan *station level*

Penamaan setiap peralatan SOGI baik pada *bay level* (IED dan lain-lain) dan *station level* (server, workstation, gateway dan lain-lain) harus unik dengan struktur tertentu yang akan dijelaskan di bawah ini.

### 5.1.1. Penamaan *bay level*

Struktur penamaan terdiri dari 12 karakter yang dapat dikelompokkan menjadi:

A	B	C	D	E
1	4	2	4	1

**Karakter A** : Kode *level* tegangan terdiri dari 1 karakter.

**Tabel 1. Karakter A**

Tegangan (kV)	Range	IEC
Tegangan Rendah (TR)	< 1 kV	N
Tegangan Menengah (TM)	1 sampai < 6 kV	M
Tegangan Menengah (TM)	6 sampai < 10 kV	L
Tegangan Menengah (TM)	10 sampai < 20 kV	K
Tegangan Menengah (TM)	20 sampai < 30 kV	J
Tegangan Menengah (TM)	30 sampai < 45 kV	H
Tegangan Tinggi (TT)	45 sampai < 60 kV	G
Tegangan Tinggi (TT)	60 sampai < 110 kV	F
Tegangan Tinggi (TT)	110 sampai < 220 kV	E
Tegangan Ekstra Tinggi (TET)	220 sampai < 380 kV	D
Tegangan Ekstra Tinggi (TET)	380 sampai ≤ 420 kV	C
Tegangan Ekstra Tinggi (TET)	> 420 kV	B

**Karakter B** : Nama bay maksimal 4 karakter.

**Tabel 2. Karakter B**

Peralatan di Gardu Induk	Format Penulisan
<i>Common</i>	COMM
IBT	IBT
Trafo	TRFO
<i>Busbar</i>	BBAR
<i>Bus Coupler</i>	BCPL
<i>Bus Section</i>	BSEC
<i>Cable Feeder</i>	CABF
OHL Feeder	OHLF
Diameter	DIAM
<i>Capasitor</i>	CAPS
<i>Reactor</i>	REAC
Generator	GENE
Gen Transf	GENT
Blok	BLOK
<i>Incoming 20kV</i>	INCO
<i>Outgoing 20kV</i>	OUTG
Trafo PS	SST
KTT (Konsumen Tegangan Tinggi)	KTT
KTET (Konsumen Tegangan Ekstra Tinggi)	KTET

**Karakter C** : Urutan *bay* 2 angka, dimulai dari angka 01 sampai dengan 99.

**Karakter D** : Jenis Peralatan maksimal 4 karakter.

**Tabel 3. Karakter D**

Jenis Peralatan	<i>Mnemonic</i>
<i>Bay Control Unit</i>	BCU
IED I/O	IO
AVR	AVR
KWH Meter	KWH
RTU/IED untuk LFC	LFC
RTU/IED untuk AGC	AGC
IED Meter	MTR
<i>Distance Relay</i>	PDIS
<i>Line Current Differential</i>	PLDF
<i>Trafo Differential Relay &amp; Restricted Earth Fault</i>	PTDF
<i>Over Current Relay, Ground Fault, Thermal Relay</i>	PTOC
<i>Circulating Current Protection</i>	PCCP
<i>Busbar Protection Relay</i>	PBDF
<i>Circuit Breaker Failure/Short Zone (CB AB)</i>	PCBF
<i>Defense Scheme Relay</i>	RDS
<i>Standby Earth Fault</i>	PSEF
<i>Unbalance Relay</i>	PPBR
<i>Switch (pada bay level)</i>	SWTC

**Karakter E :** Urutan peralatan terdiri 1 angka, dimulai dari angka 1 sampai dengan 9 atau urutan peralatan menggunakan 1 huruf, dimulai dari huruf A sampai dengan Z.

**Contoh 1:**

B	DIAM	01	BCU	2
---	------	----	-----	---

B Tegangan 500 kV

DIAM Nama *bay* Diameter

01 Urutan *bay* Diameter

BCU *Bay Control Unit*

2 Urutan IED untuk BCU AB

**Contoh 2:**

E	OHLF	02	PDIS	1
---	------	----	------	---

E Tegangan 150 kV

OHLF Nama *bay* OHL Feeder

02 Urutan *bay* OHL nomor 2

PDIS Distance *Relay* (MPU)

1 Urutan IED

**Contoh 3:**

J	OUTG	05	PTOC	1
---	------	----	------	---

J Tegangan 20 kV

OUTG Nama *bay* Outgoing 20kV

05 Urutan *bay* Outgoing 20kV nomor 5

PTOC Over Current *Relay*, Ground Fault *Relay*

1 Urutan IED

### 5.1.2. Penamaan *station level*

Struktur penamaan *station level* terdiri dari 12 karakter yang dapat dikelompokkan menjadi:

A	B	C	D
5	1	4	2

**Karakter A** : Nama Gardu Induk 5 karakter.

**Karakter B** : Kode Gardu Induk dari 1 karakter.

**Tabel 4. Karakter B**

Gardu Induk	Kode
GITET > 400 kV	7
GITET 200-400 kV	6
GI 90-200 kV	5
GI 60-90 kV	4
GI 30-60 kV	3
GI 10-30 kV	2
GI 1-10 kV	1

**Karakter C** : Jenis Peralatan maksimal 4 karakter.

**Tabel 5. Karakter C**

Jenis Peralatan	Mnemonic
Server	SERV
HMI	HMI
Printer	PRNT
GPS	GPS
Router	ROUT
Gateway	GWAY
RTU	RTU
Switch ( <i>pada station level</i> )	SWTC
Configurator	CFG
Firewall	FRWL

**Karakter D** : Urutan peralatan terdiri 2 angka, dimulai dari angka 01 sampai dengan 99

**Contoh :**

PEDAN	7	SERV	02
-------	---	------	----

PEDAN Nama GITET/GI

7 Tegangan 500 kV

SERV SERVER

02 No urut peralatan (*server* yang kedua)

Untuk peralatan yang belum ada di tabel di atas, penamaan peralatan tersebut akan ditentukan oleh PLN.

## 5.2 IP Address

Pengalamatan IP Address untuk setiap peralatan di SOGI harus unik dengan struktur tertentu yang akan dijelaskan di bawah ini. Penggunaan IP Address untuk setiap peralatan dalam satu SOGI memakai *Class B* dengan *subnet mask* 255.255.0.0 dan untuk pengelompokan IP Address sebagai berikut:

IP Address	A			B			C			D		
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	D3

### A. Lokasi control center

Tabel 6. Lokasi control center

<b>Control center</b>			<b>Keterangan</b>		
A1	A2	A3	130 - 189		
x	x	x	Jawa Bali		
x	x	x	Sumatera		
x	x	x	Kalimantan		
x	x	x	Sulawesi		
x	x	x	NTB, NTT		
x	x	x	Maluku		
x	x	x	Papua		

**B. Nomor urut Gardu Induk****Tabel 7. Nomor urut Gardu Induk**

Gardu Induk			Keterangan	
B1	B2	B3	0 - 254	
X	X	X	Nomor GI	0-254

**C. Level dan nomor urut bay****Tabel 8. Level dan nomor urut bay**

Level	Nomor urut bay		Keterangan	
C1	C2	C3	0 - 254	
0	X	X	Bay Level/Transmisi	000-099
1	X	X	Bay Level/Distribusi	100-199
2	X	X	Station Level	200-254

**D. Jenis dan nomor urut IED****Tabel 9. Jenis dan nomor urut IED**

Jenis Peralatan		Number	Keterangan	
D1	D2	D3	1 - 254	
0	0	X	Bay Control Unit	001-009
0	1	X	IED I/O	010-019
0	2	X	AVR	020-029
0	3	X	KWH Meter	030-039
0	4	X	RTU/IED untuk LFC/AGC	040-049
0	5	X	IED Meter	050-059
0	6	X	Distance Relay	060-069
0	7	X	Line Current Differential	070-079
0	8	X	Trafo Differential Relay & Restricted Earth Fault	080-089

<b>Jenis Peralatan</b>		<b>Number</b>	<b>Keterangan</b>	
0	9	x	<i>Over Current Relay, Ground Fault, Thermal Relay</i>	090-099
1	0	x	<i>Circulating Current Protection</i>	100-109
1	1	x	<i>Busbar Protection Relay</i>	110-119
1	2	x	<i>Circuit Breaker Failure/Short Zone (CB AB)</i>	120-129
1	3	x	<i>Defense Scheme Relay</i>	130-139
1	4	x		140-149
1	5	x	<i>Standby Earth Fault</i>	150-159
1	6	x	<i>Unbalance Relay</i>	160-169
1	7	x	<i>Switch</i>	170-199
1	8	x		
1	9	x		
2	0	x	<i>Server</i>	200-209
2	1	x	<i>HMI + Printer</i>	210-219
2	2	x	<i>Gateway /RTU</i>	220-229
2	3	x	<i>Router</i>	230-234
2	3	x	<i>GPS</i>	235-239
2	4	x	<i>Configurator</i>	240-249
2	5	x	<i>Firewall</i>	250-254

Untuk peralatan yang belum ada di tabel di atas, *IP Address* peralatan tersebut akan ditentukan oleh PLN.

Contoh IP Address:

**133.21.2.2**

- 133      Nomor *control center* UP2B Jateng dan DIY
- 21        Nomor urut GI/GITET berdasarkan *database* di *control center*
- 2          Nomor urut *bay* atau *diameter*
- 2          Urutan IED untuk BCU AB

### 5.3 Penamaan teleinformasi

*Logical Node (LN), Data Object (DO), Common Data Class (CDC), Data Attribute (DA), dan Functional Constraint (FC)* untuk Sistem/Gardu Induk baru menggunakan IEC 61850 edisi 2.1 (*mandatory*) atau edisi 2 (*optional*). Sedangkan untuk pengembangan atau penambahan peralatan/bay baru pada Sistem/ Gardu Induk yang sudah menggunakan IEC 61850, edisi IEC 61850 menyesuaikan dengan edisi IEC 61850 pada Sistem/Gardu Induk eksisting dengan tetap mengacu ke standar IEC 61850 sesuai edisinya dan mengikuti rekomendasi dari IEC 61850.

#### 5.3.1. *Logical Node (LN) dan Data Object (DO)*

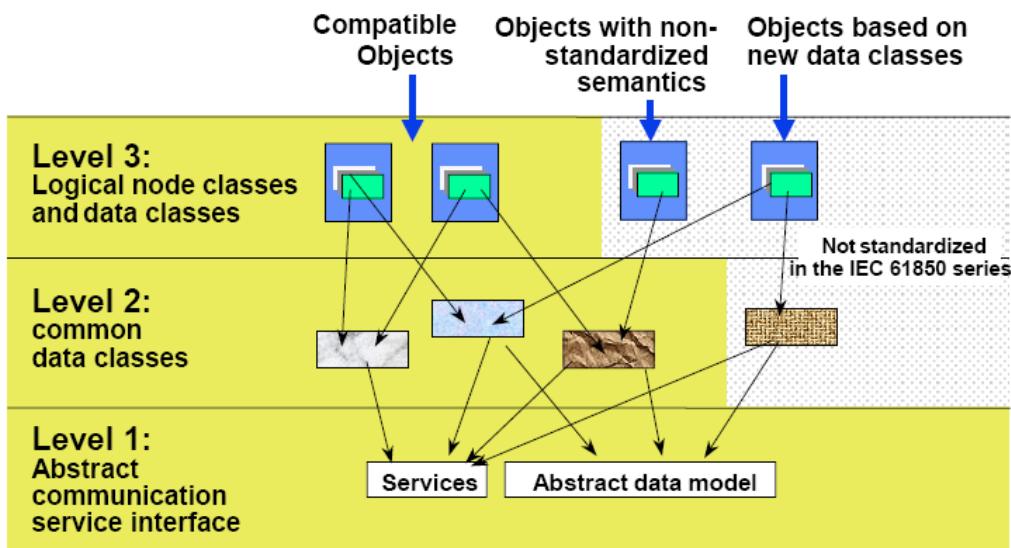
*Logical Node (LN)* dan *Data Object (DO)* setiap tipe IED harus dicek dan diuji di PLN. *Mapping Teleinformasi Data (TID)* fungsi operasi ke IEC 61850 dapat dilihat di tabel pada lampiran SPLN ini. TID yang digunakan adalah berdasarkan SPLN S5.001-1: 2020, Teleinformasi Data Untuk Operasi Jaringan Tenaga Listrik, Bagian 1: Sistem Penyaluran. Sedangkan untuk LN dan DO berdasarkan IEC 61850-7-4 tahun 2010 Amandemen 1 Tahun 2020 (IEC 61850 edisi 2.1). Untuk TID yang belum ada di tabel pada lampiran SPLN ini (contohnya TID untuk fungsi pemeliharaan), mapping LN dan DO-nya akan ditentukan oleh PLN berdasarkan IEC 61850-7-4 dan standar yang terkait.

Tabel *mapping TID fungsi operasi pada sistem penyaluran ke IEC 61850 Edisi 2.1* pada LAMPIRAN 1, dan tabel data *object semantic IEC 61850 Edisi 2.1* pada LAMPIRAN 2.

Untuk LN dan DO yang tidak tertulis pada tabel tersebut harus mengikuti standar yang ada pada IEC 61850 dan standar yang terkait.

#### 5.3.2. *Common Data Class (CDC), Data Attribute (DA), dan Functional Constraint (FC)*

Pada pemodelan data dan service IEC 61850, *Common Data Class (CDC)* didefinisikan pada level 2. *Common Data Class* mendefinisikan informasi terstruktur yang terdiri dari satu *Data Attribute* atau lebih. Tipe *Data Attribute* dapat berupa tipe dasar (misalnya *INTEGER*) sebagaimana didefinisikan dalam IEC 61850-7-1. Tipe data banyak didefinisikan sebagai tipe *Common Data Attribute* di level 2. *Data class* (dan *Logical Node Class*) sebagaimana didefinisikan di level 3 adalah spesialisasi dari CDC sesuai dengan penggunaan spesifiknya dalam konteks aplikasi. [IEC TR 61850-1].



IEC 1381/03

**Gambar 3 The Modelling approach of the IEC 61850 series**

Common Data Class (CDC), Data Attribute (DA), dan Functional Constraint (FC) setiap tipe IED harus dicek dan diuji di PLN. CDC, DA dan FC harus mengikuti tabel-tabel pada lampiran di SPLN ini. CDC, DA dan FC tersebut adalah berdasarkan IEC 61850-7-3 tahun 2010 Amandemen 1 Tahun 2020 (IEC 61850 edisi 2.1).

Tabel Common Data Class (CDC) IEC 61850 Edisi 2.1 ada di LAMPIRAN 3 , tabel Data Attribute Semantic IEC 61850 Edisi 2.1 ada di LAMPIRAN 7, dan tabel Functional Constraint (FC) IEC 61850 Edisi 2.1 ada di LAMPIRAN 8.

Untuk CDC dan DA yang tidak tertulis pada tabel-tabel tersebut, harus mengikuti standar yang ada pada IEC 61850 dan standar yang terkait.

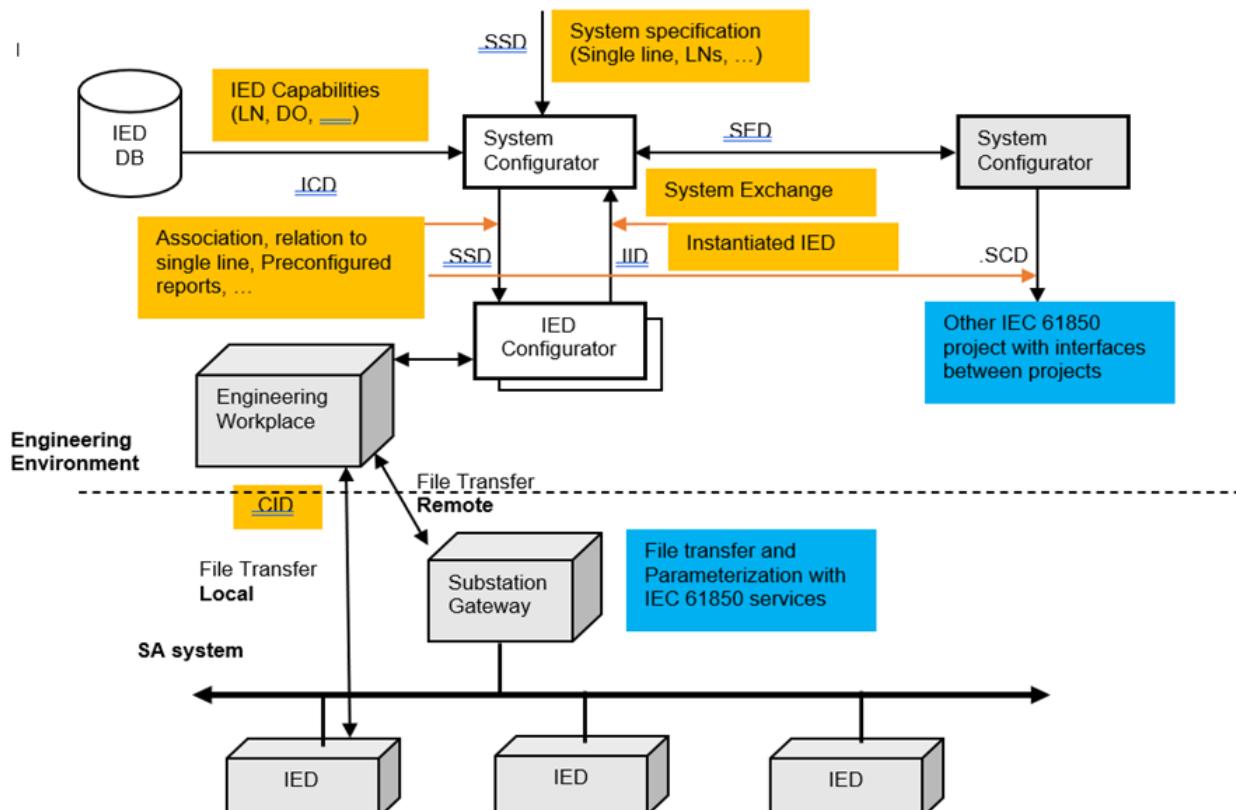
## 5.4 Format/sintaks SCL

SCL merupakan bahasa konfigurasi yang digunakan agar pertukaran deskripsi dan parameter dari suatu peralatan dan juga parameter sistem antar *tool* dari berbagai pabrikan dapat kompatibel. SCL didefinisikan dalam IEC 61850-6. SCL ini digunakan untuk:

- Menggambarkan kemampuan IED dalam hal model IEC 61850-5 dan IEC 61850-7-x untuk impor ke *system engineering tool*.
- Menggambarkan semua data yang diperlukan dalam menentukan parameter sistem pada IED. Ini termasuk melakukan proses *binding* IED dan fungsinya pada gardu itu sendiri, dalam hal *Single Line Diagram*, dan tempatnya dalam sistem komunikasi.

Bahasa SCL ini didasarkan pada XML. Tipe-tipe file ekstensi pada SCL antara lain:

- IID : *Instantiated IED Description*
- ICD : *IED Capability Description*
- CID : *Configured IED Description*
- SCD : *Substation Configuration Description*
- SSD : *System Specification Description*
- SED : *System Exchange Description*



Gambar 4 Model referensi untuk alur informasi *configuration process*

Format/*sintaks* SCL setiap tipe peralatan SOGI dan peralatan yang menggunakan protokol IEC 61850 (IED, server, gateway dan lain-lain) harus dicek dan diuji di PLN. Software yang digunakan oleh setiap peralatan SOGI dan peralatan yang menggunakan protokol IEC 61850 baik untuk konfigurasi ataupun untuk operasi (*run time*) harus dapat menerima (*import*) dan menghasilkan (*export*) file SCL dengan format/*sintaks* SCL mengikuti *schema* yang ada pada lampiran SPLN ini, secara otomatis (tidak diperlukan secara manual) dan tidak menimbulkan *error* (masalah), baik menggunakan software konfigurator/*run time* ataupun menggunakan software konverter SCL tambahan dan atau software bisa melakukan pengambilan konfigurasi SCL secara langsung dari IED yang menggunakan protokol IEC 61850.

Dengan mengikuti skema ini, diharapkan akan mempermudah dalam integrasi antar peralatan yang menggunakan protokol IEC 61850, karena sudah tidak ada *error* (masalah) lagi dalam pertukaran file SCL. *Schema* untuk SCL ini adalah berdasarkan IEC 61850-6 tahun 2009 Amandemen Tahun 2019 (IEC 61850 edisi 2.1). Seluruh peralatan di lingkungan PLN yang menggunakan protokol IEC 61850, baik SOGI dan di luar SOGI, harus mengikuti *schema* untuk SCL yang ada dalam LAMPIRAN 9.

Format/*sintaks* SCL IEC 61850 edisi 2.1 diimplementasikan pada Sistem/Gardu Induk baru. Sedangkan untuk pengembangan atau penambahan peralatan/bay baru pada Sistem/Gardu Induk yang sudah menggunakan IEC 61850, edisi IEC 61850 menyesuaikan dengan edisi IEC 61850 pada Sistem/ Gardu Induk eksisting dengan tetap mengacu ke standar IEC 61850 sesuai edisinya dan mengikuti rekomendasi dari IEC 61850.

Format/*sintaks* SCL harus mengikuti *schema* yang ada pada LAMPIRAN 9  
*SCL syntax: XML schema definition*

Semua peralatan SOGI dan peralatan yang menggunakan protokol IEC 61850 harus dicek dan diuji penamaan dan penulisan IEC 61850 di PLN dengan menggunakan acuan SPLN ini.

Pengujian penamaan dan penulisan IEC 61850 ini melengkapi uji fungsi *remote station* yang ada pada SPLN S6.003: 2020, Uji Fungsi *Remote Station* atau SPLN edisi terakhir. Item uji penamaan dan penulisan IEC 61850 meliputi:

1. Penamaan *bay level* dan *station level*;
2. IP Address;
3. *Logical Node (LN)*, *Data Object (DO)*, *Common Data Class (CDC)*, *Data Attribute (DA)*, dan *Functional Constraint (FC)*;
4. Format/*sintaks* SCL.

Kriteria kelulusan peralatan yang diuji adalah dapat mengikuti aturan penamaan dan penulisan IEC 61850 pada SPLN ini.

**LAMPIRAN 1****Tabel Mapping TID fungsi operasi pada sistem penyaluran ke IEC 61850 Edisi 2.1**

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
		<b>STEP POSISI</b>								
1	RPOS	RELAI TARGET POSITION	1	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
2	TPI	TAP POSITION INDICATION	2	YLTC	Tap changer	TapPos	Operating with value in 'ctlVal' initiates the tap position adjustment to the specified value. The change of its position indicates the result of operation.	ISC		
				ATCC	Automatic tap changer controller	TapPos	(Controllable) Tap position change to the specified value.	ISC		
		<b>STEP COMMAND (ST)</b>								
1	TC	TAP CHANGER RAISE/LOWER	1	ATCC	Automatic tap changer controller	TapChg	(Controllable) Tap position adjustment in given direction (raise, lower), or adjustment stop (stop).	BSC		
		<b>TELE MEASUREMENT (TM )</b>								
1	F	FREKUENSI	1	MMXU	Measurement	Hz	Frequency [Hz].	MV		
2	V	TEGANGAN ANTAR FASA	2	MMXU	Measurement	PPV	Phase to phase voltages.	DEL		
3	I	ARUS PADA SETIAP FASA	3	MMXU	Measurement	A	Phase to ground/phase to neutral three phase currents.	WYE		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
4	P	DAYA AKTIF	4	MMXU	Measurement	TotW	Total real power in a three-phase circuit [W].	MV		
5	Q	DAYA REAKTIF	5	MMXU	Measurement	TotVAr	Total reactive power in a three-phase circuit [VAr].	MV		
6	PF	POWER FACTOR (FAKTOR DAYA/COS PHI)	6	MMXU	Measurement	TotPF	Average power factor in a three-phase circuit.	MV		
7	CCB	COUNTER OF CIRCUIT BREAKER	7	XCBR	Circuit breaker	OpCnt	Inherited from: SwitchingEquipmentLN. Count of operations; not resettable from remote, but may be reset from local.	INS		
8	TEMPT1	TEMPERATUR TRANSFORMER DI KUMPARAN PRIMER	8	SPTR	Power transformer supervision	HPTmpClc	Calculated winding hotspot temperature [°C].	MV	*	
9	TEMPT2	TEMPERATUR TRANSFORMER DI KUMPARAN SEKUNDER	9	SPTR	Power transformer supervision	HPTmpClc	Calculated winding hotspot temperature [°C].	MV	*	
10	TEMPT3	TEMPERATUR TRANSFORMER DI KUMPARAN DI OLTC	10	TTMP	Temperature sensor	TmpSv	Sampled temperature measurement [°C]	SAV	-	
11	PRES	PRESSURE	11	SIMG	Insulation medium supervision (gas)	Pres	Inherited from: LineSupervisionLN. Pressure of the insulating medium.	MV	*	
12	POAQ	REAL POWER SETTING	12	ZGEN	Generator	DmdW	Demanded active power.	ASG	*	
13	PRAQ	MAX POWER VARIATION SETTING	13	ZGEN	Generator	WRtg	Rated active power.	ASG	*	
14	AMPF	ARUS GANGGUAN MAKSUMUM	14	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
15	RH	RELATIVE HUMIDITY	15	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
16	HCLL	HIGH CAPABILITY LEVEL LIMIT (DAYA MAMPU MAKSUMUM/DMN)	16	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
17	LCLL	LOW CAPABILITY LEVEL LIMIT (DAYA MAMPU MINIMUM/TML)	17	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
18	HOLL	HIGH OPERATION LEVEL LIMIT	18	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
19	LOLL	LOW OPERATION LEVEL LIMIT	19	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
20	RRUP	RAMP RATE UP GENERATOR (MW/MENIT)	20	FRMP	Ramp function	RmpUp	Ramping rate on an upward trend.	ASG		
21	RRDW	RAMP RATE DOWN GENERATOR (MW/MENIT)	21	FRMP	Ramp function	RmpDn	Ramping rate on a downward trend.	ASG		
22	DISS	JARAK GANGGUAN (KM)	22	RFLO	Fault locator	FltDiskm	Fault distance [km].	MV		
23	WINDS	KECEPATAN ANGIN	23	MMET	Meteorological information	HorWdSpd	Average horizontal wind speed.	MV	*	
					atau					
				MMET	Meteorological information	VerWdSpd	Average vertical wind speed.	MV	*	
24	WIAGL	SUDUT ANGIN	24	MMET	Meteorological information	HorWdDir	Total horizontal wind direction.	MV	*	
					atau					
				MMET	Meteorological information	VerWdDir	Vertical wind direction.	MV	*	
25	LUXL	INTENSITAS CAHAYA MATAHARI (LUX)	25	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
26	TEMPL	SUHU LINGKUNGAN	26	MMET	Meteorological information	EnvTmp	Temperature of environment [°C].	MV	*	
27	HUML	KELEMBABAN LINGKUNGAN	27	MMET	Meteorological information	EnvHum	Humidity of environment (typically in %).	MV	*	
28	PREL	TEKANAN UDARA LINGKUNGAN	28	MMET	Meteorological information	EnvPres	Barometric pressure of environment.	MV	*	
29	ANGDF	BEDA SUDUT DUA SISTEM	29	RSYN	Synchronism check	DifAngClc	Inherited from: SynchronisationLN. Phase angle difference calculated for two measurements. The accuracy and calculation method is a local issue.	MV		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
			atau							
				CSYN	Synchronizer controller	DifAngClc	Inherited from: SynchronisationLN. Phase angle difference calculated for two measurements. The accuracy and calculation method is a local issue.	MV		
30	BCAP	BATERAI CAPACITY (MWh)	30	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
31	BTRM	BATERAI TIME REMAIN (MINUTES)	31	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
32	LCAP	LOAD CAPACITY (%)	32	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
33	CTPI	COUNTER TAP POSITION INDICATION	33	YLTC	Tap changer	OpCntRs	Inherited from: ControlledLN. (controllable) Operations count, can be reset to a value different than 0.	INC		
34	EPOS	SUDUT SOLAR CELL TERHADAP ARAH TIMUR	34	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
35	NPOS	SUDUT SOLAR CELL TERHADAP ARAH UTARA	35	GGIO	Generic process I/O	AnIn	(GGIO) Generic analogue input n.	MV		
36	FREDF	BEDA FREKUENSI DUA SISTEM	36	RSYN	Synchronism check	DifHzClc	Inherited from: SynchronisationLN. Frequency difference calculated for two actual frequency measurements. The accuracy and calculation method is a local issue.	MV		
Atau										
				CSYN	Synchronizer controller	DifHzClc	Inherited from: SynchronisationLN. Frequency difference calculated for two actual frequency measurements. The accuracy and calculation method is a local issue.	MV		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
37	VODF	BEDA TEGANGAN DUA SISTEM	37	RSYN	Synchronism check	DifVClc	Inherited from: SynchronisationLN.Voltage magnitude difference (average value) calculated for two voltage measurements. The accuracy and calculation method is a local issue.	MV		
				CSYN	Synchronizer controller	DifVClc	Inherited from: SynchronisationLN. Voltage magnitude difference (average value) calculated for two voltage measurements. The accuracy and calculation method is a local issue.	MV		
		REMOTE CONTROL DIGITAL (RCD)								
1	DCBC	DUMMY CIRCUIT BREAKER CLOSED/OPENED	1	CSWI	Switch controller	Pos	(Controllable) Circuit breaker / switch position. For a hand-operated circuit breaker / switch, the (optional) 'ctlVal' does not exist – only the status 'stVal' can be read.	DPC		
2	CB	CIRCUIT BREAKER CLOSED/OPENED	2	CSWI	Switch controller	Pos	(Controllable) Circuit breaker / switch position. For a hand-operated circuit breaker / switch, the (optional) 'ctlVal' does not exist – only the status 'stVal' can be read.	DPC		
3	BI	BUS ISOLATOR SWITCH CLOSED/OPENED	3	CSWI	Switch controller	Pos	(Controllable) Circuit breaker / switch position. For a hand-operated circuit breaker / switch, the (optional) 'ctlVal' does not exist – only the status 'stVal' can be read.	DPC		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
4	TCC	TAP CHANGER AUTO/MANUAL	4	ATCC	Automatic tap changer controller	Auto	Inherited from: AutomaticControlLN. (controllable) If true, output circuit of the automatic controller has been enabled (control is automatic), otherwise control is manual.	SPC	-	
5	TC	TAP CHANGER RAISE/LOWER	5	ATCC	Automatic tap changer controller	TapChg	(Controllable) Tap position adjustment in given direction (raise, lower), or adjustment stop (stop).	BSC		
6	CSO	CHECK SYNCHRONIZING OVERRIDE	6	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
7	SAM	SYNCHRONIZATION AUTO/MANUAL	7	CSYN	Synchronizer controller	OpModSyn	(Controllable) Operating mode for synchronisation.	ENC (SynchOperationMode Kind)		
8	RMT	RESET MASTER TRIP	8	GGIO	Generic process I/O	SPCSO	(Controllable) Generic double point controllable status output n.	SPC		
9	GUC	GENERATOR UNIT RUN/STOP	9	ZGEN	Generator	GnCtl	(Controllable) Start/stop status of the machine.	DPC		
10	LFR	LOAD FREQ REQUEST ON/OFF	10	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
11	CAM	CAPASITOR AUTO/MANUAL	11	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
		REMOTE CONTROL ANALOG (RCA)								
1	POOP	REAL POWER SET POINT (AGC LOAD SET POINT)	1	FSPT	Setpoint control function	SptVal	(controllable) Value of setpoint. Analog value (MX) feeds back the setpoint of the controller.	APC	*	
2	PROP	MAX POWER VARIATION SET POINT	2	FSPT	Setpoint control function	SptVal	(controllable) Value of setpoint. Analog value (MX) feeds back the setpoint of the controller.	APC	*	
3	N	LOAD FREQ CONTROL N_LEVEL (LFC)	3	FSPT	Setpoint control function	SptVal	(controllable) Value of setpoint. Analog value (MX) feeds back the setpoint of the controller.	APC	*	

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
4	PG	SETTING DAYA AKTIF AGC	4	FSPT	Setpoint control function	SptVal	(controllable) Value of setpoint. Analog value (MX) feeds back the setpoint of the controller.	APC	*	
		TELESIGNAL DOUBLE ( TSD )								
1	DCBC	DUMMY BREAKER CLOSED/OPENED	1	XCBR	Circuit breaker	Pos	Inherited from: SwitchingEquipmentLN. (controllable) Circuit breaker/switch position.	DPC		
2	CB	CIRCUIT BREAKER CLOSED/OPENED	2	XCBR	Circuit breaker	Pos	Inherited from: SwitchingEquipmentLN. (controllable) Circuit breaker/switch position.	DPC		
3	BI	BUS ISOLATOR SWITCH CLOSED/OPENED	3	XSWI	Circuit switch	Pos	Inherited from: SwitchingEquipmentLN. (controllable) Circuit breaker/switch position.	DPC		
4	LI	LINE ISOLATOR SWITCH CLOSED/OPENED	4	XSWI	Circuit switch	Pos	Inherited from: SwitchingEquipmentLN. (controllable) Circuit breaker/switch position.	DPC		
5	LR	LOCAL REMOTE	5	XSWI	Circuit switch	Loc	Inherited from: SwitchingEquipmentLN. If true, the control behaviour is allowed at this level.	SPS		
6	LRT	LOCAL/REMOTE SWITCH FOR TAPCHANGER	6	ATCC	Automatic tap changer controller	Loc	Inherited from: ControllingLN. If true, the control behaviour is allowed at this level.	SPS		
7	TCC	TAP CHANGER AUTO/MANUAL	7	ATCC	Automatic tap changer controller	Auto	Inherited from: AutomaticControlLN. (controllable) If true, output circuit of the automatic controller has been enabled (control is automatic), otherwise control is manual.	SPC		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
8	TC	TAP CHANGER RAISE/LOWER	8	ATCC	Automatic tap changer controller	TapChg	(Controllable) Tap position adjustment in given direction (raise, lower), or adjustment stop (stop).	BSC		
				YLTC	Tap changer	TapChg	(Controllable) Tap position adjustment in given direction (raise, lower), or adjustment stop (stop).	BSC		
9	CSO	CHECK SYNCHRONIZING OVERRIDE	9	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
10	ES	EARTH SWITCH CLOSED/OPENED **)	10	XSWI	Circuit switch	Pos	Inherited from: SwitchingEquipmentLN.(controllable) Circuit breaker/switch position.	DPC		
11	RACK	CIRCUIT BREAKER RACKIN/RACKOUT	11	XSWI	Circuit switch	Pos	Inherited from: SwitchingEquipmentLN. (controllable) Circuit breaker/switch position.	DPC		
12	TFAM	TRANSFORMER FAN AUTO/MANUAL	12	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
13	SAM	SYNCHRONIZATION AUTO/MANUAL	13	CSYN	Synchronizer controller	OpModSyn	(Controllable) Operating mode for synchronisation.	ENC (SynchOperationMode Kind)		
14	RMT	RESET MASTER TRIP	14	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
15	GUC	GENERATOR UNIT RUN/STOP	15	ZGEN	Generator	GnCtl	(Controllable) Start/stop status of the machine.	DPC		
16	LFR	LOAD FREQ REQUEST ON/OFF	16	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
17	CD	CONTROL DISABLE SWITCH	17	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
18	CAM	CAPASITOR AUTO/MANUAL	18	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
19	LFC	LOAD FREQ CONTROL ON/OFF SWITCH	19	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
20	LFA	LOAD FREQ AVAILABLE/NOT AVAILABLE	20	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
21	INCHM	OPERATION IN INVERTER MODE / CHARGER MODE	21	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
		TELESIGNAL SINGLE (TSS)								
1	VACF	VAC FAILURE	1	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
2	VDCF	VDC FAILURE	2	GGIO	Generic process I/O	DPCSO	(Controllable) Generic double point controllable status output n.	DPC		
3	PHA	PERIPHERAL ALARM	3	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
4	AR	CIRCUIT BREAKER AUTO RECLOSE	4	RREC	Autoreclosing	AutoRecSt	Current autoreclosing status.	ENS (AutoReclosingKind)		
5	ARO	AUTO RECLOSE OFF	5	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
6	BF	BAY FAULT	6	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
7	BRF	BREAKER FAULT	7	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
8	RTUA	REMOTE STATION ALARM	8	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
9	COM	COMMUNICATION FAULTY	9	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
10	DOOR	DOOR ACTIVATED	10	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
11	RSTA	RESET ALARM	11	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
12	CSP	CHECK SYNCHRONIZING IN PROGRESS	12	RSPN	Synchronism check	SynPrg	Inherited from: SynchronisationLN.(controllable) If true, synchronizing/ synchrocheck is in progress, otherwise synchronizing/synchrocheck has been stopped	SPC		
			atau							
				CSYN	Synchronizer controller	SynPrg	Inherited from: SynchronisationLN. (controllable) If true, synchronizing/ synchrocheck is in progress, otherwise synchronizing/synchrocheck has been stopped	SPC		
13	OCPA	OIL CABLE PRESSURE ALARM	13	SIML	Insulation medium supervision (liquid)	InsAlm	Inherited from: LineSupervisionLN. If true, a predefined level limit for the insulation capability has been reached (for example, low insulation level). Setting of the predefined level limit is a local issue. The action is to restore the full insulation capability.	SPS	*	
14	PWF	PILOT WIRE FAILURE	14	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
15	RTN	RELAY TEGANGAN NOL	15	PTUV	Undervoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
16	SYNF	SYNCHRONIZING FAILURE	16	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
17	FPO	FIRE PROTECTION OPERATED	17	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
18	TEA	TEMPERATURE ALARM	18	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
19	TET	TEMPERATURE TRIP	19	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
20	TRA	TRANSFORMER ALARM	20	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
21	TRT	TRANSFORMER TRIP	21	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
22	RCFF	REAKTOR COOLING FAN FAILURE	22	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
23	RF	REAKTOR FAILURE	23	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
24	RA	REAKTOR ALARM	24	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
25	RT	REAKTOR TRIP	25	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
26	TAF	TRANFORMER AVR FAILURE	26	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
27	TCA	TAP CHANGER ALARM	27	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
28	TCT	TAP CHANGER TRIP	28	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
29	TPIF	TAP POSITION INDICATION FAILURE	29	ATCC	Automatic tap changer controller	TapOpErr	If true, there was an error in tap position change, or in tap indication (for instance, wrong Binary Coded Decimal (BCD) code).	SPS		
30	TCH	TAP CHANGER HIGH LIMIT	30	YLTC	Tap changer	EndPosR	If true, the load tap changer has reached the maximum raise position.	SPS		
31	TCL	TAP CHANGER LOW LIMIT	31	YLTC	Tap changer	EndPosL	If true, the load tap changer has reached the maximum lower position.	SPS		
32	TCFF	TRANSFORMER COOLING FAN FAILURE	32	CCGR	Cooling group control	FanOvCur	If true, fan overcurrent trip has been issued.	SPS	*	
33	TCPF	TRANSFORMER COOLING PUMP FAILURE	33	CCGR	Cooling group control	PmpOvCur	If true, pump overcurrent trip has been issued.	SPS	*	
34	VS	VOLTAGE STATUS	34	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
35	FRA	FIRE ALARM	35	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
36	FRSF	FIRE ALARM SYSTEM FAILURE	36	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
37	POT	PROTECTION ON TEST	37	LLN0	Logical device LN	Beh	Read-only value, describing the behaviour of the logical device. For a root logical device, it is the same as the mode ('LLN0.Mod'). For non-root logical device, it depends on its own current operating mode ('LLN0.Mod'), and the current operating behaviour of the logical device that contains it (containing 'LLN0.Beh').	ENS (BehaviourModeKind)		
38	GOV	FREE ACTING GOVERNOR ACTIVE	38	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
39	AVR	AUTOMATIC VOLTAGE REGULATOR ON/OFF	39	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
40	AQR	AUTOMATIC POWER FACTOR REGULATOR ACTIVE	40	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
41	LFF	LOAD FREQ CONTROL UNIT FAILURE	41	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
42	UT	UNIT TRIP	42	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
43	GTT	GENERATOR TRANSFORMER TRIP	43	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
44	LOWCT	LOW OIL PRESSURE CABLE TRIP	44	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
45	PRDT	PRESSURE RELAY DEVICE TRIP	45	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
46	MTO	MASTER TRIP OPERATE	46	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
47	UVR	UNDER VOLTAGE RELAY OPERATE	47	PTUV	Undervoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
48	OVR	OVER VOLTAGE RELAY OPERATE	48	PTOV	Overvoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
49	PTF	PROTECTION FAULTY	49	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
50	TTR	TELEPROTECTION TRIP RECEIVE	50	PSCH	Protection scheme	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
51	TTT	TELEPROTECTION TRIP TRANSMIT	51	PSCH	Protection scheme	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
52	P1BP	BUSBAR PROTECTION	52	PDIF	Differential	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
53	P1CD	CURRENT DEFFERENTIAL	53	PDIF	Differential	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
54	P1DEF	DIRECTIONAL EARTH FAULT	54	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
55	P1DIF	DIFFERENTIAL	55	PDIF	Differential	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
56	P1REF	RESTRICTED EARTH FAULT	56	PDIF	Differential	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
57	P1Z1	DISTANCE PROTECTION ZONE 1	57	PDIS	Distance	Op	If its 'general'=true, the function decided to trip due to distance fault. The trip itself is issued by PTRC.	ACT		
58	P1Z2	DISTANCE PROTECTION ZONE 2	58	PDIS	Distance	Op	If its 'general'=true, the function decided to trip due to distance fault. The trip itself is issued by PTRC.	ACT		
59	P1Z3	DISTANCE PROTECTION ZONE 3	59	PDIS	Distance	Op	If its 'general'=true, the function decided to trip due to distance fault. The trip itself is issued by PTRC.	ACT		
60	P2GFR	GROUND FAULT RELAY	60	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
61	P2OCR	OVER CURRENT RELAY	61	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
62	P3DTT	DIRECT TRANSFER TRIP	62	PSCH	Protection scheme	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
63	CBTR	CB TRIP	63	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
64	SIB	SOFTWARE INTERLOCKING BYPASS	64	LLN0	Logical device LN	SwModKey	If true, switch mode is set to switching without interlocking checks (also called S 1 switch mode key). Can be changed locally or by remote control from operator.	SPC		
65	IEDF	IED FAULTY	65	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
66	SOTF	SWITCH ON TO FAULT	66	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
67	INVA	INVERTER ALARM	67	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
68	INVF	INVERTER FAILURE	68	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
69	INVT	INVERTER TRIP	69	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
70	CHRA	CHARGER ALARM	70	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
71	CHRF	CHARGER FAILURE	71	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
72	CHRT	CHARGER TRIP	72	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		
73	UFRP	RELAY UNDER FREQUENCY PICKUP	73	PTUF	Underfrequency	Str	Inherited from: FrequencyProtectionLN. If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'.	ACD		
74	UFRT1	UNDER FREQUENCY RELAY STAGE 1 OPERATE	74	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
75	UFRT2	UNDER FREQUENCY RELAY STAGE 2 OPERATE	75	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
76	UFRT3	UNDER FREQUENCY RELAY STAGE 3 OPERATE	76	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
77	UFRT4	UNDER FREQUENCY RELAY STAGE 4 OPERATE	77	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
78	UFRT5	UNDER FREQUENCY RELAY STAGE 5 OPERATE	78	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
79	UFRT6	UNDER FREQUENCY RELAY STAGE 6 OPERATE	79	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
80	UFRT7	UNDER FREQUENCY RELAY STAGE 7 OPERATE	80	PTUF	Underfrequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
81	UFRD1	UNDER FREQUENCY RELAY ROC 1 OPERATE	81	PFRC	Rate of change of frequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
82	UFRD2	UNDER FREQUENCY RELAY ROC 2 OPERATE	82	PFRC	Rate of change of frequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020						
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note
83	UFRD3	UNDER FREQUENCY RELAY ROC 3 OPERATE	83	PFRC	Rate of change of frequency	Op	Inherited from: FrequencyProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
84	OLSP	RELAY OVER LOAD SHEDDING PICKUP	84	PTOC	Time overcurrent	Str	Inherited from: CurrentProtectionLN. If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'.	ACD	
85	OLST1	OVERLOAD SHEDDING STAGE 1 OPERATE	85	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
86	OLST2	OVERLOAD SHEDDING STAGE 2 OPERATE	86	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
87	OLST3	OVERLOAD SHEDDING STAGE 3 OPERATE	87	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
88	OLST4	OVERLOAD SHEDDING STAGE 4 OPERATE	88	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
89	OLST5	OVERLOAD SHEDDING STAGE 5 OPERATE	89	PTOC	Time overcurrent	Op	Inherited from: CurrentProtectionLN. If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
90	UVLS1	UNDER VOLTAGE LOAD SHEDDING STAGE 1 OPERATE	90	PTUV	Undervoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	
91	UVLS2	UNDER VOLTAGE LOAD SHEDDING STAGE 2 OPERATE	91	PTUV	Undervoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT	

SPLN TID FUNGSI OPERASI PADA SISTEM PENYALURAN 2020			IEC 61850-7-4 CSV 2020							
NO	MNEMO	NAMA SINYAL	NO	LN	LN Description	DO	DO Explanation	CDC (61850-7-3)	Note	
92	UVLS3	UNDER VOLTAGE LOAD SHEDDING STAGE 3 OPERATE	92	PTUV	Undervoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
93	OGSP	RELAY OVER GENERATOR SHEDDING PICKUP	93	PTOC	Time overcurrent	Str	Inherited from: CurrentProtectionLN. If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'.	ACD		
94	OFGS1	OVER GENERATOR SHEDDING STAGE 1 OPERATE	94	PTOC	Time overcurrent	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
95	OFGS2	OVER GENERATOR SHEDDING STAGE 2 OPERATE	95	PTOC	Time overcurrent	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
96	OFGS3	OVER GENERATOR SHEDDING STAGE 3 OPERATE	96	PTOC	Time overcurrent	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
97	OVLS1	OVER VOLTAGE SHEDDING STAGE 1 OPERATE	97	PTOV	Overvoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
98	OVLS2	OVER VOLTAGE SHEDDING STAGE 2 OPERATE	98	PTOV	Overvoltage	Op	If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.	ACT		
99	AGCL	AGC Limit	99	GGIO	Generic process I/O	Ind	If true, indication n is present.	SPS		

\* Jika implementasi di lapangan masih menggunakan transducer atau peralatan lainnya untuk mengambil data tersebut, diperbolehkan menggunakan GGIO dengan DO sbb :

- AnIn untuk Tele Metering
- AnOut untuk Remote Control Analog
- Ind untuk Tele Signal

**LAMPIRAN 2**  
**Tabel DO (*Data Object*) Semantic IEC 61850 Edisi 2.1**

Name	Type	(Used in) Description
A	WYE	(MMXU) Phase to ground/phase to neutral three phase currents.
AnIn	MV	GGIO) Generic analogue input n.
Auto	SFC	AutomaticControlLN) (controllable) If true, output circuit of the automatic controller has been enabled (control is automatic), otherwise control is manual
AutoRecSt	ENS (AutoReclosingKind)	(RREC) Current autoreclosing status.
Beh	ENS (BehaviourModeKind)	(LLNO) Read-only value, describing the behaviour of the logical device. For a root logical device, it is the same as the mode ('LLNO.Mod'). For non-root logical device, it depends on its own current operating mode ('LLNO.Mod'), and the current operating behaviour of the logical device that contains it (containing 'LLNO.Beh'). (DomainLN) Read-only value, describing the behaviour of a domain logical node. It depends on the current operating mode of the logical node ('DomainLN.Mod'), and the current operating mode of the logical device that contains it ('LLNO.Mod'). Processing of the quality status ('q') of the received datap
DifAngClc	MV	(SynchronisationLN) Phase angle difference calculated for two measurements. The accuracy and calculation method is a local issue.
DifHzClc	MV	(SynchronisationLN) Frequency difference calculated for two actual frequency measurements. The accuracy and calculation method is a local issue.
DifVClc	MV	SynchronisationLN) Voltage magnitude difference (average value) calculated for two voltage measurements. The accuracy and calculation method is a local issue.
DmdW	ASG	(ZGEN) Demanded active power.

Name	Type	(Used in) Description
DPCSO	DBC	(Double point controllable status output) (controllable) Generic double point controllable status output n.
EndPosL	SPS	(YEFN) If true, the end position lower has been reached.(YLTC) If true, the load tap changer has reached the maximum lowerposition.(ATCC) If true, the
EndPosR	SPS	YEFN) If true, the end position raise has been reached. (YLTC) If true, the load tap changer has reached the maximum raise position. (ATCC) If true, end position raise or highest allowed tap position has been reached.
EnvHum	MV	(IMMET) Humidity of environment (typically in %).
EnvPres	MV	(IMMET) Barometric pressure of environment.
EnvTmp	MV	(CCGR) Temperature of the environment.
FanOvCur	SPS	(CCGR) If true, fan overcurrent trip has been issued.
FltDiskm	MV	(RFLO) Fault distance [km].
GnCtl	DPC	(ZGEN) (controllable) Start/stop status of the machine. (ZRRC) (controllable) Start/stop status of the machine.
HorWdDir	MV	(IMMET) Total horizontal wind direction.
HorWdSpd	MV	(IMMET) Average horizontal wind speed.
HPTmpClc	MV	(SPTR) Calculated winding hotspot temperature [°C].
Hz	Hz	(HarmonicsLN) Basic frequency measurement [Hz].
Ind	SPS	(GGIO) If true, indication n is present. (GAPC) If true, indication n is present.
InsAlm	SPS	(LineSupervisionLN) If true, a predefined level limit for the insulation capability has been reached (for example, low insulation level). Setting of the predefined level limit is a local issue. The action is to restore the full insulation capability.

Name	Type	(Used in) Description
Loc	SPS	<p>(LLN0) If true, the control behaviour is allowed at this level. At bay level, "local" means operation from the bay unit and "remote" means operation from a station unit. At process level, "local" means direct operation on the process device (for example on a circuit breaker) and "remote" means operation from a bay unit. If this 'Loc' (in the logical device) is in contradiction to the 'Loc' of another contained logical node, "local" is always dominant (see also AnnexB).</p> <p>(NonProcessControllingEquipmentInterfaceLN) If true, the control behaviour is allowed at this level.</p> <p>(SwitchingEquipmentLN) If true, the control behaviour is allowed at this level.</p> <p>(ControllingLN) If true, the control behaviour is allowed at this level.</p>

Name	Type	(Used in) Description
Op	ACT (T)	(GAPC) If its 'general' is true, protection function decided to trip. The trip itself is issued by PTRC.(ThresholdLN) If its 'general' is true, the function decided to trip. The trip itself is issued by PTRC.(CurrentProtectionLN) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PSDE) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PTEF) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(FrequencyProtectionLN) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(GeneratorProtectionLN) If its 'general'=true, the function decided to trip due to phase angle or rotor condition. The trip itself is issued by PTRC. In case of rotor or thyristor protection, both field and generator breakers will be tripped. (MotorStartupProtectionLN) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PowerProtectionLN) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PowerFactorProtectionLN) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PTOV) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PTUV) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PVPH) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PDIF) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PDIR) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC. The trip condition is satisfied if all direction sensors activated by the fault(Pxxx.Str.dirxyz) point to the surrounded object. The definition of these sensors surrounding the object is done statically at engineering time and if necessary for the object dynamically using information e.g. of switch positions. (PDIS) If its 'general'=true, the function decided to trip due to distance fault. The trip itself is issued by PTRC.(PHIZ) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PIOC) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PSCH) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PSOF) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PTDV) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PTRC) If its 'general'=true, the function decided to trip, as a combination of subscribed 'Pxxx.Op' from protection functions. (PTTR) If its 'general'=true, the function decided to trip. The trip itself is issued by PTRC.(PZSU) If its 'general'=true, the function decided to trip due to speed condition. The trip itself is issued by PTRC.(RPSB) If its 'general'=true, the function decided to trip (out of step tripping). The trip itself is issued by PTRC.

Name	Type	(Used in) Description
OpCnt	INS	(SwitchingEquipmentLN) Count of operations; not resettable from remote, but may be reset from local. (ZSAR) Count of operations; not resettable from remote, but may be reset from local. (KVLV) Count of operations; not resettable from remote, but may be reset from local. (YLTC) Count of operations; not resettable from remote, but may be reset from local. (SPDC) Count of partial discharges; not resettable from remote, but may be reset from local.
OpCntRs	INC	(ISAF) (controllable) Operations count, can be reset to a value different than 0.(ControlledLN) (controllable) Operations count, can be reset to a value different than 0.(ProtectionLN) Operating with a value in 'ctlVal' initiates the resetting of the operations count, possibly to a value different than 0. The change of count value indicates the result of operation.(PowerQualityLN) (controllable) Operations count, can be reset to a value different than 0.(RecorderLN) (controllable) Operations count, can be reset to a value different than 0.(SupervisionLN) (controllable) Operations count, can be reset to a value different than 0.(GLOG) (controllable) Operations count, can be reset to a value different than 0.(GSAL) (controllable) Operations count, can be reset to a value different than 0.(RBRF) (controllable) Operations count, can be reset to a value different than 0.(RFLO) (controllable) Operations count, can be reset to a value different than 0.(RPSB) (controllable) Operations count, can be reset to a value different than 0.
OpModSyn	ENC (SynchOperationModeKind)	CSYN) (controllable) Operating mode for synchronisation.
PmpOvCur	SPS	CCGR) If true, pump overcurrent trip has been issued.
Pos	DPC	(SwitchingEquipmentLN) (controllable) Circuit breaker/switch position. (KVLV) (controllable) Valve position. (YPSH) (controllable) Position of the switch of power shunt. (CSWI) (controllable) Circuit breaker / switch position. For a handoperated circuit breaker / switch, the (optional) 'ctlVal' does not exist – only the status 'stVal' can be read. (CPOW) (controllable) Circuit breaker / switch position.
PPV	DEL	(MMXU) Phase to phase voltages.
Pres	MV	LineSupervisionLN) Pressure of the insulating medium. (SPRS) Measured pressure.
RmpDn	ASG	(FRMP) Ramping rate on a downward trend.
RmpUp	ASG	FRMP) Ramping rate on an upward trend.

Name	Type	(Used in) Description
SPCSO	SPC	GGIO) (controllable) If true, generic single point controllable status output n has been enabled, otherwise it has been disabled. (GAPC) (controllable) If true, generic single point controllable status output n has been enabled, otherwise it has been disabled.
SptVal	APC	(FSPT) (controllable) Value of setpoint. Analog value (MX) feeds back the setpoint of the controller.
Str	ACD	GAPC) If its 'general' is true, a fault has been detected and its direction may be available in its 'dirGeneral'. (CurrentProtectionLN) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PSDE) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PTEF) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (FrequencyProtectionLN) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (GeneratorProtectionLN) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PMSS) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PowerProtectionLN) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PowerFactorProtectionLN) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (VoltageProtectionLN) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PDIF) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PDIR) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PDIS) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PHAR) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PHIZ) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PIOC) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PSOF) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PTDV) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PTRC) If its 'general'=true, a fault has been detected, as a combination of subscribed 'Pxxx.Str' from protection functions, and its direction may be available in its 'dirGeneral'. (PTTR) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'. (PZSU) If its 'general'=true, a fault has been detected and its

Name	Type	(Used in) Description
		direction may be available in its 'dirGeneral'. (RBRF) If its 'general'=true, a failed breaker has been detected, and the timer for retrip has started running. The fault direction may be available in its 'dirGeneral'. (RPSB) If its 'general'=true, a fault has been detected and its direction may be available in its 'dirGeneral'.
SwModKey	SPC	(LLNO) If true, switch mode is set to switching without interlocking checks(also called S 1 switch mode key). Can be changed locally or by remotecontrol from operator.(CSWI) If true, switch mode is set to switching without interlockingchecks (also called S1 switch mode key). Can be changed locally or byremote control from operator.
SynPrg	SPC	SynchronisationLN) (controllable) If true, synchronizing/synchrocheck is in progress, otherwise synchronizing/synchrocheck has been stopped.
TapChg	BSC	(YEFN) (controllable) Tap position adjustment in given direction (raise,lower), or adjustment stop (stop). (YLTC) (controllable) Tap position adjustment in given direction (raise,lower), or adjustment stop (stop). (ANCR) (controllable) Tap position adjustment in given direction (raise,lower), or adjustment stop (stop). (ARCO) (controllable) Tap position adjustment in given direction (raise,lower), or adjustment stop (stop). (ATCC) (controllable) Tap position adjustment in given direction (raise,lower), or adjustment stop (stop). (AVCO) (controllable) Tap position adjustment in given direction (raise,lower), or adjustment stop (stop).
TapOpErr	SPS	(ATCC) If true, there was an error in tap position change, or in tap indication (for instance, wrong Binary Coded Decimal (BCD) code).
TapPos	ISC	(YLTC) Operating with value in 'ctlVal' initiates the tap position adjustment to the specified value. The change of its position indicates the result of operation. (ATCC) (controllable) Tap position change to the specified value.
TmpSv	SAV	(TTMP) Sampled temperature measurement [°C].
TotPF	MV	(MMXU) Average power factor in a three-phase circuit.
TotVAr	MV	(MMXU) Total reactive power in a three-phase circuit [VAr].
TotW	MV	(MMXU) Total real power in a three-phase circuit [W].
VerWdDir	MV	(IMMET) Vertical wind direction.
VerWdSpd	MV	(IMMET) Average vertical wind speed.
WRtg	ASG	(ZGEN) Rated active power. (ZSMC) Rated active power.

**LAMPIRAN 3**  
**Tabel Common Data Class (CDC) IEC 61850 Edisi 2.1**

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
<b>A. Status information</b>								
1	SPS	Single point status	stVal	BOOLEAN	ST	dchg	Value of the data.	M
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	M
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'stVal' or 'q'.	M
2	INS	<<statistics>> Integer status	stVal	INT32	ST	dchg , dupd	Value of the data.	M
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	M
			t	Timestamp	ST		Timestamp of the last change or update event of 'stVal' or the last change of value in 'q'.	M
3	ENS	<<abstract>> Enumerated status	stVal	EnumDA	ST	dchg , dupd	Value of the data.	M
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	M
			t	Timestamp	ST		Timestamp of the last change or update event of 'stVal' or the last change of value in 'q'.	M

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
4	ACT	Protection activation information	general	BOOLEAN	ST	dchg	General indication of a command operation or of a protection activation (e.g. by the fault). Depending on the function, 'general' may or may not be resulting from the phase attributes ('phsA', 'phsB', 'phsC', 'neut'). I.e. 'general' may be set while none of the 'phsX'/neut' is set, 'general' shall be set if one of the 'phsX'/neut' is set.	M
			phsA	BOOLEAN	ST	dchg	Value true indicates a command, a trip or a start event of phase A.	O
			phsB	BOOLEAN	ST	dchg	Value true indicates a command, a trip or a start event of phase B.	O
			phsC	BOOLEAN	ST	dchg	Value true indicates a command, a trip or a start event of phase C.	O
			neut	BOOLEAN	ST	dchg	Value true indicates a start event with earth current.	O
			q	Quality	ST	qchg	Quality of the values in 'general', 'phsA', 'phsB', 'phsC', 'neut'.	M
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'general', 'phsA', 'phsB', 'phsC', 'neut' or 'q'.	M

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			originSrc	Originator	ST		Originator of a control action forwarded by a GOOSE message. NOTE This attribute may be used to identify the originator when a data of the ACT is used to perform an operation. An example would be the data object 'CSWI.OpOpn' used to open a breaker (XCBR) through a GOOSE message. The LN XCBR receives 'CSWI.OpOpn' including the originator as a GOOSE message. Once operated, the new status information in 'XCBR.Pos' will include the originator information it received as part of the GOOSE message that triggered the operation.	O
			operTmPhsA	Timestamp	ST		Operation time for phase A, used for point on wave switching.	O
			operTmPhsB	Timestamp	ST		Operation time for phase B, used for point on wave switching.	O
			operTmPhsC	Timestamp	ST		Operation time for phase C, used for point on wave switching.	O
5	ACD	Directional protection indication information	general	BOOLEAN	ST	dchg	General indication of a protection activation (e.g. by the fault). Depending on the function, 'general' may or may not be resulting from the phase attributes (phsA', 'phsB', 'phsC', 'neut'). I.e. 'general' may be set while none of the 'phsX'/neut' is set, 'general' shall be set if one of the 'phsX'/neut' is set.	M
			dirGeneral	FaultDirectionKind	ST	dchg	General direction of the fault. If the faults of individual phases have different directions, this attribute shall be set to 'dirGeneral'='both'.	M

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			phsA	BOOLEAN	ST	dchg	Value true indicates a trip or a start event of phase A.	AllOrNonePerGroup(1)
			dirPhsA	PhaseFaultDirectionKind	ST	dchg	Direction of the fault for phase A.	AllOrNonePerGroup(1)
			phsB	BOOLEAN	ST	dchg	Value true indicates a trip or a startevent of phase B.	AllOrNonePerGroup(2)
			dirPhsB	PhaseFaultDirectionKind	ST	dchg	Direction of the fault for phase B.	AllOrNonePerGroup(2)
			phsC	BOOLEAN	ST	dchg	Value true indicates a trip or a start event of phase C.	AllOrNonePerGroup(3)
			dirPhsC	PhaseFaultDirectionKind	ST	dchg	Direction of the fault for phase C.	AllOrNonePerGroup(3)
			neut	BOOLEAN	ST	dchg	See 'ACT.neut'. 'ACT.neut' : Value true indicates a start event with earth current.	AllOrNonePerGroup(4)
			dirNeut	PhaseFaultDirectionKind	ST	dchg	Direction of the fault for earth current.	AllOrNonePerGroup(4)
			q	Quality	ST	qcchg	Quality of the values in 'general', 'dirGeneral', 'phsA', 'dirPhsA', 'phsB', 'dirPhsB', 'phsC', 'dirPhsC', 'neut', 'dirNeut'.	M
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'general', 'dirGeneral', 'phsA', 'dirPhsA', 'phsB', 'dirPhsB', 'phsC', 'dirPhsC', 'neut', 'dirNeut' or 'q'.	M
B.	Measurand information							

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
1	MV	<<statistics>> Measured value	instMag	AnalogueValue	MX		Instantaneous value of the magnitude. NOTE 'instMag' is optional from the perspective of the visibility of that value to the communication. The instantaneous value may be required for the internal behaviour of the function, e.g. to perform the deadband calculation for 'mag'.	O
			mag	AnalogueValue	MX	dchg , dupd	Value of the magnitude based on a deadband calculation from the instantaneous value 'instMag'. The value of 'mag' shall be updated to the current instantaneous value 'instMag' when the value has changed according to the configuration parameter 'db'. If 'db'=0, 'mag'='instMag'. NOTE 1 This value is typically used to create reports for analogue values. Such a report sent "by exception" is not comparable to the transfer of sampled measured values as supported by the CDC SAV. NOTE 2 This 'mag' is not the same as 'mag' of the constructed attribute class 'Vector'.	M

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			range	RangeKind	MX	dchg	Range in which the current instantaneous value 'instMag' is. A transition of 'instMag' to another range generates a change in this attribute that may be used to trigger a report with trigger option 'data-change' (see RangeConfig). 'instMag' can be a local value, i.e. does not need to be visible over the communication for implementing the range attribute. NOTE The use of algorithms to filter events based on transition from one range to another is a local issue. Depending on the update rate of the 'instMag', a fast change of the value may result in non-consecutive values of this 'range'; e.g. 'range' can be reported as 'low-low' and 'high-high' in two consecutive updates.	O
			q	Quality	MX	qchg	Quality of the values in 'instMag', 'mag', 'range'.	M
			t	Timestamp	MX		Timestamp of the last refresh of the value in 'mag' or of the last change of the value in any of 'range' or 'q'.	M
2	CMV	<<statistics>> Complex measured value	instCVal	Vector	MX		Instantaneous complex value. See 'MV.instMag' for details.	O
			cVal	Vector	MX	dchg , dupd	Complex value based on a deadband calculation from the instantaneous value 'instCVal.mag'. The deadband calculation is done both on 'instCVal.mag' (based on 'db') and on 'instCVal.ang' (based on 'dbAng'), independently. See 'MV.mag'.	M

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			range	RangeKind	MX	dchg	Range in which the currentinstantaneous value 'instCVal.mag' is.See 'MV.range'.	O
			rangeAng	RangeKind	MX	dchg	Range in which the current instantaneous angle 'instCVal.ang' is. See 'MV.range'.	O
			q	Quality	MX	qchg	Quality of the values in 'instCVal', 'cVal', 'range', 'rangeAng'.	M
			t	Timestamp	MX		Timestamp of the last refresh of the value in 'cVal' or of the last change of the value in any of 'range', 'rangeAng' or 'q'.	M
3	SAV	<<statistics>> Sampled value (SAV)	instMag	AnalogueValue	MX		Magnitude of the instantaneous value.	M
			q	Quality	MX	qchg	Quality of the value in 'instMag'.	M
			t	Timestamp	MX		Timestamp of the last refresh of the value in 'instMag' or of the last change of the value in 'q'.	O
4	WYE	<<statistics>> Phase to ground/neutral related measured values of a three phase system	phsA	<b>CMV</b>			Value of phase A.	AtLeastOne(1)
			phsB	<b>CMV</b>			Value of phase B.	AtLeastOne(1)
			phsC	<b>CMV</b>			Value of phase C.	AtLeastOne(1)

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			neut	<b>CMV</b>			Value of the measured phase neutral. If a direct measurement of this value is not available, it is acceptable to substitute an estimate computed by creating the algebraic sum of the instantaneous values of currents flowing through all live conductors ('phsA.instCVal'+'phsB.instCVal'+'phsC.instCVal'); in that case, 'neut'='res'.	AtLeastOne(1)
			net	<b>CMV</b>			Net current, as the algebraic sum of the instantaneous values of currents flowing through all live conductors and the neutral of a circuit at one point of the electrical installation ('phsA.instCVal'+'phsB.instCVal'+'phsC.instCVal'+'neut.instCVal').	AtLeastOne(1)
			res	<b>CMV</b>			Residual current, as the algebraic sum of the instantaneous values of currents flowing through all live conductors of a circuit at one point of the electrical installation ('phsA.instCVal'+'phsB.instCVal'+'phsC.instCVal').	AtLeastOne(1)
4	DEL	<<statistics>> Phase to phase related measured values of a three-phase system	phsAB	<b>CMV</b>			Value of phase A to phase B measurement.	AtLeastOne(1)
			phsBC	<b>CMV</b>			Value of phase B to phase C measurement.	AtLeastOne(1)

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			phsCA	<b>CMV</b>			Value of phase C to phase A measurement.	AtLeastOne(1)
C.	<b>Controls</b>							
1	SPC	Controllable single point	origin	Originator	ST		Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O
			ctlNum	INT8U	ST		The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O
			stVal	BOOLEAN	ST	dchg	Status value of the controllable data object.	MAIOrNonePerGroup(1)
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	MAIOrNonePerGroup(1)
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'stVal' or 'q'.	MAIOrNonePerGroup(1)
			stSel	BOOLEAN	ST	dchg	True means that the controllable data object is in the status "selected".	MOsbo
2	DPC	Controllable double point	origin	Originator	ST		See 'SPC.origin'. 'SPC.origin' : Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			ctlNum	INT8U	ST		See 'SPC.ctlNum'. 'SPC.ctlNum' : The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O
			stVal	DpStatusKind	ST	dchg	Status value of the controllable data object.	M
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	M
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'stVal' or 'q'.	M
			stSelD	BOOLEAN	ST	dchg	See 'SPC.stSelD'. 'SPC.stSelD' : True means that the controllable data object is in the status "selected".	MOsbo
3	INC	<<statistics>> Controllable integer status	origin	Originator	ST		See 'SPC.origin'. 'SPC.origin' : Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O
			ctlNum	INT8U	ST		See 'SPC.ctlNum'. 'SPC.ctlNum' : The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O
			stVal	INT32	ST	dchg , dupd	Status value of the controllable data object.	M
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	M
			t	Timestamp	ST		Timestamp of the last change or update event of 'stVal', or the last change of value in 'q'.	M

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			stSelD	BOOLEAN	ST	dchg	See 'SPC.stSelD'. 'SPC.stSelD' : True means that the controllable data object is in the status "selected".	MOsbo
4	ENC	<<abstract>> Controllable enumerated status	origin	Originator	ST		See 'SPC.origin'. 'SPC.origin' : Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O
			ctlNum	INT8U	ST		See 'SPC.ctlNum'. 'SPC.ctlNum' : The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O
			stVal	EnumDA	ST	dchg	Status value of the controllable data object.	M
			q	Quality	ST	qchg	Quality of the value in 'stVal'.	M
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'stVal' or 'q'.	M
			stSelD	BOOLEAN	ST	dchg	See 'SPC.stSelD'. 'SPC.stSelD' : True means that the controllable data object is in the status "selected".	MOsbo
5	BSC	<<statistics>> Binary controlled step position information	origin	Originator	ST		See 'SPC.origin'. 'SPC.origin' : Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O
			ctlNum	INT8U	ST		See 'SPC.ctlNum'. 'SPC.ctlNum' : The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			valWTr	ValWithTrans	ST	dchg	Status value of the controllable data object.	MAIOrNonePerGroup(1)
			q	Quality	ST	qcchg	Quality of the value in 'valWTr'.	MAIOrNonePerGroup(1)
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'valWTr' or 'q'.	MAIOrNonePerGroup(1)
			stSelD	BOOLEAN	ST	dchg	See 'SPC.stSelD'. 'SPC.stSelD' : True means that the controllable data object is in the status "selected".	MOsbo
6	ISC	<<statistics>> Integer controlled step position information	origin	Originator	ST		See 'SPC.origin'. 'SPC.origin' : Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O
			ctlNum	INT8U	ST		See 'SPC.ctlNum'. 'SPC.ctlNum' : The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O
			valWTr	ValWithTrans	ST	dchg	Status value of the controllable data object.	MAIOrNonePerGroup(1)
			q	Quality	ST	qcchg	Quality of the value in 'valWTr'.	MAIOrNonePerGroup(1)
			t	Timestamp	ST		Timestamp of the last change of the value in any of 'valWTr' or 'q'.	MAIOrNonePerGroup(1)

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			stSelD	BOOLEAN	ST	dchg	See 'SPC.stSelD'. 'SPC.stSelD' : True means that the controllable data object is in the status "selected".	MOsbo
7	APC	<<statistics>> Controllable analogue process value	origin	Originator	MX		See 'SPC.origin'. 'SPC.origin' : Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.	O
			ctlNum	INT8U	MX		See 'SPC.ctlNum'. 'SPC.ctlNum' : The control sequence number of the last control service. It mirrors the appropriate contents of the control service.	O
			mxVal	AnalogueValue	MX	dchg	Current value of the controllable analogue process value or of the setpoint; details must be provided in the semantic definition of the controllable data object using this CDC.	MAIOrNonePerGroup(1)
			q	Quality	MX	qchg	Quality of the value in 'mxVal'.	MAIOrNonePerGroup(1)
			t	Timestamp	MX		Timestamp of the last change of the value in any of 'mxVal' or 'q'.	MAIOrNonePerGroup(1)
			stSelD	BOOLEAN	MX	dchg	See 'SPC.stSelD'. 'SPC.stSelD' : True means that the controllable data object is in the status "selected".	MOsbo
C.	<b>Analogue settings</b>							
1	ASG	<<abstract>> Analogue setting	units	Unit	CF	dchg	Unit for 'setMag', 'minVal', 'maxVal', 'stepSize'.	O

No	CDC	CDC Description	Attribute Name (Data Attribute)	Attribute Type	FC	TrgOp	(Value/Value range) Description	PresCond
			sVC	ScaledValueConfig	CF	dchg	Configuration for scaled value representation ('setMag', 'minVal', 'maxVal', 'stepSize').	MFscaled AV
			minVal	AnalogueValue	CF	dchg	Minimum setting for 'setMag'.	O
			maxVal	AnalogueValue	CF	dchg	Maximum setting for 'setMag'.	O
			stepSize	AnalogueValue	CF	dchg	(range=[0...(maxVal-minVal)]) Step between the individual values of 'setMag'.	O
			d	VisString255	DC		Inherited from: BasePrimitiveCDC 'd' : Textual description of the data. In case it is used within the CDC LPL, the description refers to the logical node.	O
			dU	Unicode255	DC		Inherited from: BasePrimitiveCDC 'dU' : Textual description of the data using unicode characters. In case it is used within the CDC LPL, the description refers to the logical node.	O
			cdcName	VisString255	EX		Inherited from: BasePrimitiveCDC 'cdcName' : Name of the common data class. For details see IEC 61850-7-1.	O
			dataNs	VisString255	EX		Inherited from: BasePrimitiveCDC 'dataNs' : Data name space. For details, see IEC 61850-7-1. If present, the value shall be initialized through the SCL configuration file to a valid name space.	MOdataNs

**LAMPIRAN 4**  
**Tabel Attribute Type**

Attribute type	Description
AnalogueValue	<p>Analogue values may be represented as a basic type integer (attribute 'i') or as a floating point (attribute 'f'). At least one of the attributes shall be used. If both 'i' and 'f' exist, the application in the server shall insure that both values remain consistent. When the analogue values represent measured process value, they shall be the primary values.</p> <p>i - INT32 : Integer representation of the measured value. The formula to convert between 'i' and the process value (pVal) shall be:  <math>pVal = ('i' * 'ScaledValueConfig.scaleFactor') + 'ScaledValueConfig.offset'</math> in ['Unit.SIUnit'].</p> <p>f - FLOAT32 : Floating point representation of the measured value. The formula to convert between 'f' and the process value (pVal) shall be:  <math>pVal = 'f' * 10^{\exp('Unit.multiplier')}</math> in ['Unit.SIUnit'].</p>
BOOLEAN	Boolean: {false, true}.
DpStatusKind	<p>Double point status kind.</p> <ul style="list-style-type: none"> <li>- intermediate-state : 0 -&gt; Equipment is in intermediate state.</li> <li>- off : 1 -&gt; Equipment is open.</li> <li>- on : 2 -&gt; Equipment is closed.</li> <li>- bad-state : 3 -&gt; The server cannot detect whether the position is open (off), closed (on) or in intermediate state.</li> </ul>
EnumDA	IEC 61850-7-4xx defines additional enumerations that are used in the common data classes ENC, ENG and ENS as “Enumerated data attribute types”. Within the specification of the common data class in IEC 61850-7-3, for these types the placeholder “EnumDA” is used. In IEC 61850-7-4xx, reference to these types is made through the name of the common data class and the type name in parenthesis (e.g. ENS (HealthKind))
FaultDirectionKind	<p>Kind of fault direction.</p> <ul style="list-style-type: none"> <li>- unknown : 0</li> <li>- forward : 1</li> <li>- backward : 2</li> <li>- both : 3</li> </ul>
FLOAT32	Single-precision floating point according to IEEE 754).
INT32	Signed integer: [-2 147 483 648, 2 147 483 647].
INT8U	Unsigned integer: [0, 255].
Originator	This type shall be used to describe the originator of a control operation.- orCat : OriginatorCategory Kind -> Category indicates who/what caused the control operation. If the initiator of a change is not known, this value shall be set to 'process'.- orIdent : Octet64 -> Identification of the originator of the control operation. If the initiator of a change is not known, this value shall be set to NULL.
PhaseFaultDirectionKind	<p>Kind of phase fault direction.</p> <ul style="list-style-type: none"> <li>- unknown : 0</li> <li>- forward : 1</li> <li>- backward : 2</li> </ul>

<b>Attribute type</b>	<b>Description</b>
Quality	<p>Quality contains data that describe the quality of the data from the server.</p> <p>Quality of the data is also related to the mode of a logical node. Further details can be found in IEC 61850-7-4.</p> <p>The different quality attributes are not independent.</p> <p>Penjelasan detail ada di IEC 61850-7-2 CSV 2020 halaman 41</p>
RangeKind	<p>Kind of value range.</p> <ul style="list-style-type: none"> <li>- normal : 0</li> <li>- high : 1</li> <li>- low : 2</li> <li>- high-high : 3</li> <li>- low-low : 4</li> </ul>
ScaledValueConfig	<p>This type shall be used to configure the integer value representation of the analogue value. See AnalogueValue.i.</p> <ul style="list-style-type: none"> <li>- scaleFactor : FLOAT32 -&gt; Scaling factor for integer representation of analogue value.</li> <li>- offset : FLOAT32 -&gt; Offset for integer representation of analogue value.</li> </ul>
Timestamp	<p>(old name = TimeStamp) UTC time with the epoch of midnight (00:00:00) of 1970-01-01. The presentation is defined in the SCSMs.</p> <p>Penjelasan detail ada di IEC 61850-7-2 CSV 2020 mulai halaman 37, termasuk tentang TimeQuality</p>
Unicode255	<p>(old name = UNICODE_STRING255) Should be able to hold up to 255 Unicode characters.</p> <p>NULL string has length 0.</p>
Unit	<p>This type shall be used to represent unit and multiplier information.</p> <ul style="list-style-type: none"> <li>- SIUnit : SIUnitKind -&gt; SI unit of measure.</li> <li>- multiplier : MultiplierKind (default="") -&gt; Unit multiplier.</li> </ul>
ValWithTrans	<p>This type shall be used to indicate the position of tap changers.- posVal : INT8 -&gt; (range=[-64...63]) Step position. M- transInd : BOOLEAN -&gt; If true, the equipment is in a transient state.</p>
Vector	<p>This type shall be used to represent a coherent complex value (phasor), with magnitude and angle acquired or determined simultaneously.</p> <ul style="list-style-type: none"> <li>- mag : AnalogueValue -&gt; Magnitude of the complex value.</li> <li>- ang : AnalogueValue -&gt; (range=[-180...180]) Angle of the complex value (Unit.SIUnit='deg' and Unit.multiplier=""); angle reference is defined in the context where this type is used.</li> </ul>
VisString255	<p>(old name = VISIBLE_STRING255) Should be able to hold up to 255 characters.</p> <p>NULL string has length 0.</p>

**LAMPIRAN 5**  
**Tabel TrgOp (*Trigger Options*)**

TrgOp - Trigger options		
TrgOp	Semantic	Description
dchg	data-change	The change of the value of the associated data attribute can trigger the generation of a report or a log entry.
qchg	quality-change	The change of the value of the quality data attribute can trigger the generation of a report or a log entry.
dupd	data-update	The update of the value of the associated data attribute can trigger the generation of a report or a log entry. The updated value may be the same as the old value. An example is freezing the value of a freezable data attribute updating the value of another data attribute, which could lead to the same value it already has. Another example would be the distance to a fault that would persist, or a calculation of a minimum value over a period and the same minimum is reached in two consecutive statistical calculation windows.
dchg, dupd	dchg or dupd	Either 'dchg' or 'dupd', to be chosen at data object definition in the scope of a logical node, or at implementation.

**LAMPIRAN 6**  
**Tabel PresCond (*Presence Condition*)**

PresCond ( <i>Presence Condition</i> )	Definition
AllOrNone PerGroup(1)	
AllOrNone PerGroup(2)	Parameter n: group number (> 0). All or none of the elements of a group n shall be present.
AllOrNone PerGroup(3)	
AllOrNone PerGroup(4)	
AtLeastOne(1)	Parameter n: group number (> 0). At least one of marked elements of a group n shall be present.
M	Element is mandatory
MAllOrNonePerGroup(1)	Parameter n: group number (> 0). Element is mandatory if declared control model supports 'direct-with-enhancedsecurity' or 'sbo-with-enhanced-security', otherwise all or none of the elements of a group n shall be present.
MFscaledAV	Element is mandatory* if any sibling elements of type AnalogueValue include 'i' as a child, otherwise forbidden. *Even though devices without floating point capability cannot exchange floating point values through ACSI services, the description of scaling remains mandatory for their (SCL) configuration.
MOdataNs	Element is mandatory if the name space of its data object deviates from the name space of its logical node, otherwise optional. See IEC 61850-7-1 for use of name space.
MOsbo	Element is mandatory if declared control model supports 'sbo-with-normal-security' or 'sbo-with-enhanced-security', otherwise optional and value is of no impact.
O	Element is optional.

**LAMPIRAN 7**  
**Tabel DA (*Data Attribute*) Semantic IEC 61850 Edisi 2.1**

<b>Attribute Name (Data Attribute)</b>	<b>Description</b>
stVal	Value of the data.
cdcName	Inherited from: BasePrimitiveCDC 'cdcName' : Name of the common data class. For details see IEC 61850-7-1.
ctlNum	The control sequence number of the last control service. It mirrors the appropriate contents of the control service.
d	Inherited from: BasePrimitiveCDC 'd' : Textual description of the data. In case it is used within the CDC LPL, the description refers to the logical node.
dataNs	Inherited from: BasePrimitiveCDC 'dataNs' : Data name space. For details, see IEC 61850-7-1. If present, the value shall be initialized through the SCL configuration file to a valid name space.
dirGeneral	General direction of the fault. If the faults of individual phases have different directions, this attribute shall be set to 'dirGeneral'='both'.
dirNeut	Direction of the fault for earth current.
dirPhsA	Direction of the fault for phase A.
dirPhsB	Direction of the fault for phase B.
dirPhsC	Direction of the fault for phase C.
dU	Inherited from: BasePrimitiveCDC 'dU' : Textual description of the data using unicode characters. In case it is used within the CDC LPL, the description refers to the logical node.
general	General indication of a command operation or of a protection activation (e.g. by the fault). Depending on the function, 'general' may or may not be resulting from the phase attributes ('phsA', 'phsB', 'phsC', 'neut'). I.e.'general' may be set while none of the 'phsX'/'neut' is set, 'general' shall be set if one of the 'phsX'/'neut' is set.
general	General indication of a protection activation (e.g. by the fault). Depending on the function, 'general' may or may not be resulting from the phase attributes ('phsA', 'phsB', 'phsC', 'neut'). I.e. 'general' may be set while none of the 'phsX'/'neut' is set, 'general' shall be set if one of the 'phsX'/'neut' is set.
instMag	Instantaneous value of the magnitude.NOTE 'instMag' is optional from theperspective of the visibility of that valuet o the communication. Theinstantaneous value may be requiredfor the internal behaviour of thefunction, e.g. to perform the deadbandcalculation for 'mag'.
instMag	Magnitude of the instantaneous value.
mag	Value of the magnitude based on a deadband calculation from the instantaneous value 'instMag'. The value of 'mag' shall be updated to the current instantaneous value 'instMag' when the value has changed according to the configuration parameter 'db'. If 'db'=0, 'mag'='instMag'. NOTE 1 This value is typically used to create reports for analogue values. Such a report sent "by exception" is not comparable to the transfer of sampled measured values as supported by the CDC SAV. NOTE 2 This 'mag' is not the same as 'mag' of the constructed attribute class 'Vector'.
maxVal	Maximum setting for 'setMag'.
minVal	Minimum setting for 'setMag'.

<b>Attribute Name (Data Attribute)</b>	<b>Description</b>
mxVal	Current value of the controllable analogue process value or of the setpoint; details must be provided in the semantic definition of the controllable data object using this CDC.
net	Net current, as the algebraic sum of the instantaneous values of currents flowing through all live conductors and the neutral of a circuit at one point of the electrical installation ('phsA.instCVal'+ 'phsB.instCVal'+ 'phsC.instCVal'+ 'neut.instCVal').
neut	Value true indicates a start event with earth current.
neut	Value of the measured phase neutral. If a direct measurement of this value is not available, it is acceptable to substitute an estimate computed by creating the algebraic sum of the instantaneous values of currents flowing through all live conductors ('phsA.instCVal'+ 'phsB.instCVal'+ 'phsC.instCVal'); in that case, 'neut'='res'.
operTmPhsA	Operation time for phase A, used for point on wave switching.
operTmPhsB	Operation time for phase B, used for point on wave switching.
operTmPhsC	Operation time for phase C, used for point on wave switching.
origin	Information related to the originator of the last accepted operation on the controllable data object. It mirrors the appropriate contents of the control service. Substitution will not affect the value of 'origin'.
originSrc	Originator of a control action forwarded by a GOOSE message. NOTE This attribute may be used to identify the originator when a data of the ACT is used to perform an operation. An example would be the data object 'CSWI.OpOpn' used to open a breaker (XCBR) through a GOOSE message. The LN XCBR receives 'CSWI.OpOpn' including the originator as a GOOSE message. Once operated, the new status information in 'XCBR.Pos' will include the originator information it received as part of the GOOSE message that triggered the operation.
phsA	Value true indicates a command, a trip or a start event of phase A.
phsA	Value true indicates a trip or a start event of phase A.
phsA	Value of phase A.
phsAB	Value of phase A to phase B measurement.
phsB	Value true indicates a command, a trip or a start event of phase B.
phsB	Value true indicates a trip or a start event of phase B.
phsB	Value of phase B.
phsBC	Value of phase B to phase C measurement.
phsC	Value true indicates a command, a trip or a start event of phase C.
phsC	Value true indicates a trip or a start event of phase C.
phsC	Value of phase C.
phsCA	Value of phase C to phase A measurement.
q	Quality of the value in 'stVal'.
q	Quality of the values in 'general', 'phsA', 'phsB', 'phsC', 'neut'.
q	Quality of the values in 'general', 'dirGeneral', 'phsA', 'dirPhsA', 'phsB', 'dirPhsB', 'phsC', 'dirPhsC', 'neut', 'dirNeut'.
q	Quality of the values in 'instMag', 'mag', 'range'.

<b>Attribute Name (Data Attribute)</b>	<b>Description</b>
q	Quality of the value in 'instMag'.
q	Quality of the value in 'valWTr'.
q	Quality of the value in 'mxVal'.
range	Range in which the current instantaneous value 'instMag' is. A transition of 'instMag' to another range generates a change in this attribute that may be used to trigger a report with trigger option 'data-change' (see RangeConfig). 'instMag' can be a local value, i.e. does not need to be visible over the communication for implementing the range attribute. NOTE The use of algorithms to filter events based on transition from one range to another is a local issue. Depending on the update rate of the 'instMag', a fast change of the value may result in non-consecutive values of this 'range'; e.g. 'range' can be reported as 'low-low' and 'high-high' in two consecutive updates.
res	Residual current, as the algebraic sum of the instantaneous values of currents flowing through all live conductors of a circuit at one point of the electrical installation ('phsA.instCVal'+'phsB.instCVal'+'phsC.instCVal').
stepSize	(range=[0...(maxVal-minVal)]) Step between the individual values of 'setMag'.
stSelD	True means that the controllable data object is in the status "selected".
stVal	Status value of the controllable data object.
sVC	Configuration for scaled valuerespresentation ('setMag', 'minVal','maxVal', 'stepSize').
t	Timestamp of the last change of the value in any of 'stVal' or 'q'.
t	Timestamp of the last change or update event of 'stVal' or the last change of value in 'q'.
t	Timestamp of the last change of the value in any of 'general', 'phsA', 'phsB', 'phsC', 'neut' or 'q'.
t	Timestamp of the last change of the value in any of 'general', 'dirGeneral', 'phsA', 'dirPhsA', 'phsB', 'dirPhsB', 'phsC', 'dirPhsC', 'neut', 'dirNeut' or 'q'.
t	Timestamp of the last refresh of the value in 'mag' or of the last change of the value in any of 'range' or 'q'.
t	Timestamp of the last refresh of the value in 'instMag' or of the last change of the value in 'q'.
t	Timestamp of the last change or update event of 'stVal', or the last change of value in 'q'.
t	Timestamp of the last change of the value in any of 'valWTr' or 'q'.
t	Timestamp of the last change of the value in any of 'mxVal' or 'q'.
units	Unit for 'setMag', 'minVal', 'maxVal', 'stepSize'.
valWTr	Status value of the controllable data object.

**LAMPIRAN 8**  
**Tabel FC (*Functional Constraint*) IEC 61850 Edisi 2.1**

FC	Semantic	Description (services allowed, initial values, storage)
ST	Status information	<p>Data attribute shall represent status information.  Initial value shall be taken from the process.  Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: GOOSE control block, report control block, log control block, sampled value control block.</li> </ul>
MX	Measurands (analogue values)	<p>Data attribute shall represent measurand information.  Initial value shall be taken from the process.  Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: GOOSE control block, report control block, log control block, sampled value control block.</li> </ul>
SP	Setting (outside setting group)	<p>Data attribute shall represent setting parameter information.  Initial value shall be as configured; value shall be non-volatile.  Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– SetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– SetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: GOOSE control block, report control block, log control block.</li> </ul>
SV	Substitution	<p>Data attribute shall be used to handle substitution (see IEC 61850-7-3).  Initial behaviour of substitution shall be substitution disabled.  If the substitution handling relies on non-volatile DataAttributes, then the behaviour of substitution at restart of the IED shall be as set before the restart.  Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– SetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– SetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</li> </ul>
CF	Configuration	<p>Data attribute shall represent configuration information.  Initial value shall be as configured; value shall be non-volatile.  Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– SetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– SetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</li> </ul>

FC	Semantic	Description (services allowed, initial values, storage)
DC	Description	<p>Data attribute shall represent description (intended for humans) information. Initial value shall be as configured; value shall be non-volatile. Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– SetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– SetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</li> </ul>
SG	Setting group	<p>Data attribute shall represent the current active value of a setting member of a setting group. See SETTING GROUP CONTROL BLOCK model. Initial value shall be as configured; value shall be non-volatile. Modelling note: Applicable ACSI services:–GetDataValues– GetDataDefinition– GetDataDirectory– GetDataSetValues– GetAllDataValues– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</p>
SE	Setting group editable	<p>Data attribute shall belong to the editing services associated to a setting group. See SETTING GROUP CONTROL BLOCK model. Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetEditSGValues</li> <li>– SetEditSGValues.</li> </ul>
SR	Service response	<p>Data attribute shall represent data from different process objects with the same tracking object. These attributes are used for service tracking. Initial value of the data attribute is a private issue, e.g., all zero. Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</li> </ul>
OR	Operate received	<p>Data attribute shall represent the result of an Operate request at the data object receiving the Operate request, even if the execution of the Operate is blocked. Initial value is irrelevant / arbitrary. Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: GOOSE control block, report control block, log control block.</li> </ul>
BL	Blocking	<p>Data attribute shall be used for blocking value updates. If the value of the data attribute is volatile then the initial value shall be false, otherwise the value should be as set or configured. Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– SetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– SetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</li> </ul>

FC	Semantic	Description (services allowed, initial values, storage)
<b>EX</b>	Extended definition (application name space)	<p>Data attribute shall represent an application name space. See IEC 61850-7-1.</p> <p>Value of the data attribute shall be as configured; value shall be non-volatile.</p> <p>Modelling note: Applicable ACSI services:</p> <ul style="list-style-type: none"> <li>– GetDataValues</li> <li>– GetDataDefinition</li> <li>– GetDataDirectory</li> <li>– GetDataSetValues</li> <li>– GetAllDataValues</li> <li>– may be a DataSetMember of a DataSet referred to by any of: report control block, log control block.</li> </ul>



## LAMPIRAN 9

### **SCL syntax: XML schema definition**

#### a) Base types (**SCL\_BaseSimpleTypes.xsd**, **SCL.Enums.xsd**, **SCL\_BaseTypes.xsd**)

- File **SCL\_BaseSimpleTypes.xsd** :

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns="http://www.iec.ch/61850/2003/SCL"
    targetNamespace="http://www.iec.ch/61850/2003/SCL" elementFormDefault="qualified"
    attributeFormDefault="unqualified"
    version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.
            COPYRIGHT (c) IEC, 2016 All rights reserved. Disclaimer: The IEC disclaims liability for any
personal injury,
            property or other damages of any nature whatsoever, whether special, indirect, consequential or
compensatory, directly or
            indirectly resulting from this software and the document upon which its methods are based, use of,
or reliance upon.
        </xs:documentation>
    </xs:annotation>
    <xs:simpleType name="tConnectivityNodeReference">
        <xs:restriction base="xs:normalizedString">
            <xs:pattern value=".+/+(.+)*/">
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tAnyName">
        <xs:restriction base="xs:normalizedString"/>
    </xs:simpleType>
    <xs:simpleType name="tName">
        <xs:restriction base="tAnyName">
            <xs:minLength value="1"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tID">
        <xs:restriction base="xs:token">
            <xs:minLength value="1"/>
        </xs:restriction>
    </xs:simpleType>
```

```
<xs:maxLength value="255"/>
<xs:pattern value="\s+"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tAcsiName">
<xs:restriction base="xs:Name">
<xs:pattern value="[A-Za-z][0-9A-Za-z_]*"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tRestrName1stU">
<xs:restriction base="xs:Name">
<xs:pattern value="[A-Z][0-9A-Za-z]*"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tRestrName1stL">
<xs:restriction base="xs:Name">
<xs:pattern value="[a-z][0-9A-Za-z]*"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPAddr">
<xs:restriction base="xs:normalizedString">
<xs:minLength value="1"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSclVersion">
<xs:restriction base="tName">
<xs:pattern value="2[0-2][0-9]{2}"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSclRevision">
<xs:restriction base="xs:Name">
<xs:pattern value="[A-Z]"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSclRelease">
<xs:restriction base="xs:unsignedByte">
<xs:minExclusive value="0"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tEmpty">
```

```
<xs:restriction base="xs:normalizedString">
    <xs:maxLength value="0"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tIEDName">
    <xs:restriction base="tAcsiName">
        <xs:maxLength value="64"/>
        <xs:pattern value="[A-Za-z][0-9A-Za-z_]{0,2}"/>
        <xs:pattern value="[A-Za-z][0-9A-Za-z_]{4,63}"/>
        <xs:pattern value="[A-MO-Za-z][0-9A-Za-z_]{3}"/>
        <xs:pattern value="N[0-9A-Za-np-z][0-9A-Za-z_]{2}"/>
        <xs:pattern value="No[0-9A-Za-mo-z][0-9A-Za-z_]"/>
        <xs:pattern value="Non[0-9A-Za-df-z]"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tIEDNameIsNone">
    <xs:restriction base="tAcsiName">
        <xs:pattern value="None"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tIEDNameOrNone">
    <xs:union memberTypes="tIEDName tIEDNameIsNone"/>
</xs:simpleType>
<xs:simpleType name="tOnlyRelativeIEDName">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="#x0040;"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tIEDNameOrRelative">
    <xs:union memberTypes="tIEDName tOnlyRelativeIEDName"/>
</xs:simpleType>
<xs:simpleType name="tLDName">
    <xs:restriction base="xs:normalizedString">
        <xs:maxLength value="64"/>
        <xs:pattern value="[A-Za-z][0-9A-Za-z_]*"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLDInst">
    <xs:restriction base="xs:normalizedString">
```

```
<xs:maxLength value="64"/>
    <xs:pattern value="[A-Za-z0-9][0-9A-Za-z_]*"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLDInstOrEmpty">
    <xs:union memberTypes="tLDInst tEmpty"/>
</xs:simpleType>
<xs:simpleType name="tPrefix">
    <xs:restriction base="xs:normalizedString">
        <xs:maxLength value="11"/>
        <xs:pattern value="[A-Za-z][0-9A-Za-z_]*"/>
        <xs:pattern value="" />
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLNInst">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="[0-9]{1,12}" />
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLNInstOrEmpty">
    <xs:union memberTypes="tLNInst tEmpty"/>
</xs:simpleType>
<xs:simpleType name="tDataName">
    <xs:restriction base="tRestrNameListU">
        <xs:maxLength value="12"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDataSetName">
    <xs:restriction base="tAcsiName">
        <xs:maxLength value="32"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tCBName">
    <xs:restriction base="tAcsiName">
        <xs:maxLength value="32"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLogName">
    <xs:restriction base="tAcsiName">
        <xs:maxLength value="32"/>
    </xs:restriction>
```

```
        </xs:restriction>
    </xs:simpleType>
<xs:simpleType name="tAccessPointName">
    <xs:restriction base="xs:normalizedString">
        <xs:maxLength value="32"/>
        <xs:pattern value="[A-Za-z0-9][0-9A-Za-z_]*"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tAssociationID">
    <xs:restriction base="xs:normalizedString">
        <xs:minLength value="1"/>
        <xs:pattern value="[0-9A-Za-z]+"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tVisibleBasicLatin">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="[\u0020-\u007E;]*"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tMessageID">
    <xs:restriction base="tVisibleBasicLatin">
        <xs:minLength value="1"/>
        <xs:maxLength value="129"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tFullAttributeName">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="[a-zA-Z][a-zA-Z0-9]*(\([0-9]+\))?(\. [a-zA-Z][a-zA-Z0-9]*(\([0-9]+\))?)?*>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tFullDName">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="[A-Z][0-9A-Za-z]{0,11}(\.[a-z][0-9A-Za-z]*(\([0-9]+\))?)??">
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSubDataName">
    <xs:restriction base="tRestrName1stL">
        <xs:minLength value="1"/>
        <xs:maxLength value="60"/>
```

```

        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tNamespaceName">
        <xs:restriction base="xs:normalizedString">
            <xs:pattern value="[\&#x0020;-&\#x007E;]+:20\d\d[A-Z]?" />
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tLineType">
        <xs:restriction base="xs:normalizedString">
            <xs:minLength value="1" />
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tProcessType">
        <xs:restriction base="xs:normalizedString">
            <xs:minLength value="1" />
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tProcessName">
        <xs:restriction base="xs:normalizedString">
            <xs:pattern value=".+(./+)*" />
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tEnumStringValue">
        <xs:restriction base="xs:normalizedString">
            <xsmaxLength value="127" />
            <xs:pattern value="[\p{IsBasicLatin}\p{IsLatin-1Supplement}]*" />
        </xs:restriction>
    </xs:simpleType>
</xs:schema>

```

- File **SCL\_Enums.xsd** :

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:scl="http://www.iec.ch/61850/2003/SCL" xmlns="http://www.iec.ch/61850/2003/SCL"
    xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.

```

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```
</xs:documentation>
</xs:annotation>
<xs:include schemaLocation="SCL_BaseSimpleTypes.xsd"/>
<xs:simpleType name="tPredefinedPTypeEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="IP"/>
        <xs:enumeration value="IP-SUBNET"/>
        <xs:enumeration value="IP-GATEWAY"/>
        <xs:enumeration value="OSI-NSAP"/>
        <xs:enumeration value="OSI-TSEL"/>
        <xs:enumeration value="OSI-SSEL"/>
        <xs:enumeration value="OSI-PSEL"/>
        <xs:enumeration value="OSI-AP-Title"/>
        <xs:enumeration value="OSI-AP-Invoke"/>
        <xs:enumeration value="OSI-AE-Qualifier"/>
        <xs:enumeration value="OSI-AE-Invoke"/>
        <xs:enumeration value="MAC-Address"/>
        <xs:enumeration value="APPID"/>
        <xs:enumeration value="VLAN-PRIORITY"/>
        <xs:enumeration value="VLAN-ID"/>
        <xs:enumeration value="SNTP-Port"/>
        <xs:enumeration value="MMS-Port"/>
        <xs:enumeration value="DNSName"/>
        <xs:enumeration value="IPv6FlowLabel"/>
        <xs:enumeration value="IPv6ClassOfTraffic"/>
        <xs:enumeration value="C37-118-IP-Port"/>
        <xs:enumeration value="IP-UDP-PORT"/>
        <xs:enumeration value="IP-TCP-PORT"/>
        <xs:enumeration value="IPv6"/>
        <xs:enumeration value="IPv6-SUBNET"/>
        <xs:enumeration value="IPv6-GATEWAY"/>
        <xs:enumeration value="IPv6-IGMPv3Src"/>
        <xs:enumeration value="IP-IGMPv3Src"/>
        <xs:enumeration value="IP-ClassOfTraffic"/>
```

```
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tExtensionPTypeEnum">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="[A-Z][0-9A-Za-z\-*]"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPTypeEnum">
    <xs:union memberTypes="tPredefinedPTypeEnum tExtensionPTypeEnum" />
</xs:simpleType>
<xs:simpleType name="tPredefinedPTypePhysConnEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="Type"/>
        <xs:enumeration value="Plug"/>
        <xs:enumeration value="Cable"/>
        <xs:enumeration value="Port"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPTypePhysConnEnum">
    <xs:union memberTypes="tPredefinedPTypePhysConnEnum tExtensionPTypeEnum" />
</xs:simpleType>
<xs:simpleType name="tPredefinedAttributeNameEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="T"/>
        <xs:enumeration value="Test"/>
        <xs:enumeration value="Check"/>
        <xs:enumeration value="SIUnit"/>
        <xs:enumeration value="Oper"/>
        <xs:enumeration value="SBO"/>
        <xs:enumeration value="SBOw"/>
        <xs:enumeration value="Cancel"/>
        <xs:enumeration value="Addr"/>
        <xs:enumeration value="PRIORITY"/>
        <xs:enumeration value="VID"/>
        <xs:enumeration value="APPID"/>
        <xs:enumeration value="TransportInUse"/>
        <xs:enumeration value="IPClassOfTraffic"/>
        <xs:enumeration value="IPv6FlowLabel"/>
        <xs:enumeration value="IPAddressLength"/>
        <xs:enumeration value="IPAddress"/>
```

```
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tExtensionAttributeNameEnum">
        <xs:restriction base="tRestrName1stL">
            <xs:maxLength value="60"/>
        </xs:restriction>
    </xs:simpleType>
    <xs:simpleType name="tAttributeNameEnum">
        <xs:union memberTypes="tPredefinedAttributeNameEnum tExtensionAttributeNameEnum"/>
    </xs:simpleType>
    <xs:simpleType name="tPredefinedCommonConductingEquipmentEnum">
        <xs:restriction base="xs:Name">
            <xs:enumeration value="CBR"/>
            <xs:enumeration value="DIS"/>
            <xs:enumeration value="VTR"/>
            <xs:enumeration value="CTR"/>
            <xs:enumeration value="GEN"/>
            <xs:enumeration value="CAP"/>
            <xs:enumeration value="REA"/>
            <xs:enumeration value="CON"/>
            <xs:enumeration value="MOT"/>
            <xs:enumeration value="EFN"/>
            <xs:enumeration value="PSH"/>
            <xs:enumeration value="BAT"/>
            <xs:enumeration value="BSH"/>
            <xs:enumeration value="CAB"/>
            <xs:enumeration value="GIL"/>
            <xs:enumeration value="LIN"/>
            <xs:enumeration value="RES"/>
            <xs:enumeration value="RRC"/>
            <xs:enumeration value="SAR"/>
            <xs:enumeration value="TCF"/>
            <xs:enumeration value="TCR"/>
            <xs:enumeration value="IFL"/>
            <xs:enumeration value="FAN"/>
            <xs:enumeration value="SCR"/>
            <xs:enumeration value="SMC"/>
            <xs:enumeration value="PMP"/>
        </xs:restriction>
    </xs:simpleType>
```

```
</xs:simpleType>
<xs:simpleType name="tExtensionEquipmentEnum">
    <xs:restriction base="xs:Name">
        <xs:minLength value="3"/>
        <xs:pattern value="E[A-Z]*"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tCommonConductingEquipmentEnum">
    <xs:union memberTypes="tPredefinedCommonConductingEquipmentEnum tExtensionEquipmentEnum"/>
</xs:simpleType>
<xs:simpleType name="tPowerTransformerEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="PTR"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tTransformerWindingEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="PTW"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPredefinedGeneralEquipmentEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="AXN"/>
        <xs:enumeration value="BAT"/>
        <xs:enumeration value="MOT"/>
        <xs:enumeration value="FAN"/>
        <xs:enumeration value="FIL"/>
        <xs:enumeration value="PMP"/>
        <xs:enumeration value="TNK"/>
        <xs:enumeration value="VLV"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tExtensionGeneralEquipmentEnum">
    <xs:restriction base="xs:Name">
        <xs:minLength value="3"/>
        <xs:pattern value="E[A-Z]*"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tGeneralEquipmentEnum">
    <xs:union memberTypes="tPredefinedGeneralEquipmentEnum tExtensionGeneralEquipmentEnum"/>
```

```
</xs:simpleType>
<xs:simpleType name="tServiceSettingsNoDynEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="Conf"/>
        <xs:enumeration value="Fix"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tServiceSettingsEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="Dyn"/>
        <xs:enumeration value="Conf"/>
        <xs:enumeration value="Fix"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tRedProtEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="none"/>
        <xs:enumeration value="hsr"/>
        <xs:enumeration value="prp"/>
        <xs:enumeration value="rstp"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSMVDeliveryEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="unicast"/>
        <xs:enumeration value="multicast"/>
        <xs:enumeration value="both"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPhaseEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="A"/>
        <xs:enumeration value="B"/>
        <xs:enumeration value="C"/>
        <xs:enumeration value="N"/>
        <xs:enumeration value="all"/>
        <xs:enumeration value="none"/>
        <xs:enumeration value="AB"/>
        <xs:enumeration value="BC"/>
    </xs:restriction>
</xs:simpleType>
```

```
        <xs:enumeration value="CA"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tAuthenticationEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="none"/>
        <xs:enumeration value="password"/>
        <xs:enumeration value="weak"/>
        <xs:enumeration value="strong"/>
        <xs:enumeration value="certificate"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tAssociationKindEnum">
    <xs:restriction base="xs:token">
        <xs:enumeration value="pre-established"/>
        <xs:enumeration value="predefined"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLPHDEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="LPHD"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLLNOEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="LLNO"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSystemLNGroupEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="L[A-Z]*"/>
        <xs:pattern value="LLNO"/>
        <xs:enumeration value="LLNO"/>
        <xs:enumeration value="LPHD"/>
        <xs:enumeration value="LCCH"/>
        <xs:enumeration value="LGOS"/>
        <xs:enumeration value="LSVS"/>
        <xs:enumeration value="LTIM"/>
        <xs:enumeration value="LTMS"/>
```

```
        <xs:enumeration value="LTRK"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupAEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="A[A-Z]*"/>
        <xs:enumeration value="ANCR"/>
        <xs:enumeration value="ARCO"/>
        <xs:enumeration value="ARIS"/>
        <xs:enumeration value="ATCC"/>
        <xs:enumeration value="AVCO"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupCEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="C[A-Z]*"/>
        <xs:enumeration value="CALH"/>
        <xs:enumeration value="CCGR"/>
        <xs:enumeration value="CILO"/>
        <xs:enumeration value="CPOW"/>
        <xs:enumeration value="CSWI"/>
        <xs:enumeration value="CSYN"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupFEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="F[A-Z]*"/>
        <xs:enumeration value="FCNT"/>
        <xs:enumeration value="FCSD"/>
        <xs:enumeration value="FFIL"/>
        <xs:enumeration value="FLIM"/>
        <xs:enumeration value="FPID"/>
        <xs:enumeration value="FRMP"/>
        <xs:enumeration value="FSPT"/>
        <xs:enumeration value="FXOT"/>
        <xs:enumeration value="FXUT"/>
```

```
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupGEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="G[A-Z]*"/>
        <xs:enumeration value="GAPC"/>
        <xs:enumeration value="GGIO"/>
        <xs:enumeration value="GLOG"/>
        <xs:enumeration value="GSAL"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupIEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="I[A-Z]*"/>
        <xs:enumeration value="IARC"/>
        <xs:enumeration value="IHMI"/>
        <xs:enumeration value="ISAF"/>
        <xs:enumeration value="ITCI"/>
        <xs:enumeration value="ITMI"/>
        <xs:enumeration value="ITPC"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupKEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="K[A-Z]*"/>
        <xs:enumeration value="KFAN"/>
        <xs:enumeration value="KFIL"/>
        <xs:enumeration value="KPMP"/>
        <xs:enumeration value="KTNK"/>
        <xs:enumeration value="KVLV"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupMEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="M[A-Z]*"/>
        <xs:enumeration value="MDIF"/>
```

```
<xs:enumeration value="MENV"/>
<xs:enumeration value="MFLK"/>
<xs:enumeration value="MHAI"/>
<xs:enumeration value="MHAN"/>
<xs:enumeration value="MHYD"/>
<xs:enumeration value="MMDC"/>
<xs:enumeration value="MMET"/>
<xs:enumeration value="MMTN"/>
<xs:enumeration value="MMTR"/>
<xs:enumeration value="MMXN"/>
<xs:enumeration value="MMXU"/>
<xs:enumeration value="MSQI"/>
<xs:enumeration value="MSTA"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupPEnum">
    <xs:restriction base="xs>Name">
        <xs:length value="4"/>
        <xs:pattern value="P[A-Z]*"/>
        <xs:enumeration value="PDIF"/>
        <xs:enumeration value="PDIR"/>
        <xs:enumeration value="PDIS"/>
        <xs:enumeration value="PDOP"/>
        <xs:enumeration value="PDUP"/>
        <xs:enumeration value="PFRC"/>
        <xs:enumeration value="PHAR"/>
        <xs:enumeration value="PHIZ"/>
        <xs:enumeration value="PIOC"/>
        <xs:enumeration value="PMRI"/>
        <xs:enumeration value="PMSS"/>
        <xs:enumeration value="POPF"/>
        <xs:enumeration value="PPAM"/>
        <xs:enumeration value="PRTR"/>
        <xs:enumeration value="PSCH"/>
        <xs:enumeration value="PSDE"/>
        <xs:enumeration value="PTEF"/>
        <xs:enumeration value="PTHF"/>
        <xs:enumeration value="PTOC"/>
        <xs:enumeration value="PTOF"/>
```

```
<xs:enumeration value="PTOV"/>
<xs:enumeration value="PTRC"/>
<xs:enumeration value="PTTR"/>
<xs:enumeration value="PTUC"/>
<xs:enumeration value="PTUF"/>
<xs:enumeration value="PTUV"/>
<xs:enumeration value="PUPF"/>
<xs:enumeration value="PVOC"/>
<xs:enumeration value="PVPH"/>
<xs:enumeration value="PZSU"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupQEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="Q[A-Z]*"/>
        <xs:enumeration value="QFVR"/>
        <xs:enumeration value="QITR"/>
        <xs:enumeration value="QIUB"/>
        <xs:enumeration value="QVTR"/>
        <xs:enumeration value="QVUB"/>
        <xs:enumeration value="QVVR"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupREnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="R[A-Z]*"/>
        <xs:enumeration value="RADR"/>
        <xs:enumeration value="RBDR"/>
        <xs:enumeration value="RBRF"/>
        <xs:enumeration value="RDIR"/>
        <xs:enumeration value="RDRE"/>
        <xs:enumeration value="RDRS"/>
        <xs:enumeration value="RFLO"/>
        <xs:enumeration value="RMXU"/>
        <xs:enumeration value="RPSB"/>
        <xs:enumeration value="RREC"/>
        <xs:enumeration value="RSYN"/>
    </xs:restriction>
```

```
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupSEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="S[A-Z]*"/>
        <xs:enumeration value="SARC"/>
        <xs:enumeration value="SCBR"/>
        <xs:enumeration value="SIMG"/>
        <xs:enumeration value="SIML"/>
        <xs:enumeration value="SLTC"/>
        <xs:enumeration value="SOPM"/>
        <xs:enumeration value="SPDC"/>
        <xs:enumeration value="SPTR"/>
        <xs:enumeration value="SSWI"/>
        <xs:enumeration value="STMP"/>
        <xs:enumeration value="SVBR"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupTEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="T[A-Z]*"/>
        <xs:enumeration value="TANG"/>
        <xs:enumeration value="TAXD"/>
        <xs:enumeration value="TCTR"/>
        <xs:enumeration value="TDST"/>
        <xs:enumeration value="TFLW"/>
        <xs:enumeration value="TFRQ"/>
        <xs:enumeration value="TGSM"/>
        <xs:enumeration value="THUM"/>
        <xs:enumeration value="TLVL"/>
        <xs:enumeration value="TMGF"/>
        <xs:enumeration value="TMVM"/>
        <xs:enumeration value="TPOS"/>
        <xs:enumeration value="TPRS"/>
        <xs:enumeration value="TRTN"/>
        <xs:enumeration value="TSND"/>
        <xs:enumeration value="TTMP"/>
        <xs:enumeration value="TTNS"/>
```

```
<xs:enumeration value="TVBR"/>
<xs:enumeration value="TVTR"/>
<xs:enumeration value="TWPH"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupXEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="X[A-Z]*"/>
        <xs:enumeration value="XCBR"/>
        <xs:enumeration value="XSWI"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupYEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="Y[A-Z]*"/>
        <xs:enumeration value="YEFN"/>
        <xs:enumeration value="YLTC"/>
        <xs:enumeration value="YPSH"/>
        <xs:enumeration value="YPTR"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNGroupZEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="Z[A-Z]*"/>
        <xs:enumeration value="ZAXN"/>
        <xs:enumeration value="ZBAT"/>
        <xs:enumeration value="ZBSH"/>
        <xs:enumeration value="ZCAB"/>
        <xs:enumeration value="ZCAP"/>
        <xs:enumeration value="ZCON"/>
        <xs:enumeration value="ZGEN"/>
        <xs:enumeration value="ZGIL"/>
        <xs:enumeration value="ZLIN"/>
        <xs:enumeration value="ZMOT"/>
        <xs:enumeration value="ZREA"/>
        <xs:enumeration value="ZRES"/>
        <xs:enumeration value="ZRRC"/>
```

```
<xs:enumeration value="ZSAR"/>
<xs:enumeration value="ZSCR"/>
<xs:enumeration value="ZSMC"/>
<xs:enumeration value="ZTCF"/>
<xs:enumeration value="ZTCR"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tDomainLNEnum">
    <xs:union memberTypes="tDomainLNGroupAEnum tDomainLNGroupCEnum tDomainLNGroupFEnum
        tDomainLNGroupGEnum tDomainLNGroupIEnum tDomainLNGroupKEnum tDomainLNGroupMEnum
        tDomainLNGroupPEnum
        tDomainLNGroupQEnum tDomainLNGroupREnum tDomainLNGroupSEnum tDomainLNGroupTEnum
        tDomainLNGroupXEnum
        tDomainLNGroupYEnum tDomainLNGroupZEnum"/>
</xs:simpleType>
<xs:simpleType name="tPredefinedLNClassEnum">
    <xs:union memberTypes="tSystemLNGroupEnum tDomainLNEnum"/>
</xs:simpleType>
<xs:simpleType name="tExtensionLNClassEnum">
    <xs:restriction base="xs:Name">
        <xs:length value="4"/>
        <xs:pattern value="[A-Z]+"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tLNClassEnum">
    <xs:union memberTypes="tPredefinedLNClassEnum tExtensionLNClassEnum"/>
</xs:simpleType>
<xs:simpleType name="tPredefinedCDCEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="SPS"/>
        <xs:enumeration value="DPS"/>
        <xs:enumeration value="INS"/>
        <xs:enumeration value="ENS"/>
        <xs:enumeration value="ACT"/>
        <xs:enumeration value="ACD"/>
        <xs:enumeration value="SEC"/>
        <xs:enumeration value="BCR"/>
        <xs:enumeration value="HST"/>
        <xs:enumeration value="VSS"/>
```

```
<xs:enumeration value="MV"/>
<xs:enumeration value="CMV"/>
<xs:enumeration value="SAV"/>
<xs:enumeration value="WYE"/>
<xs:enumeration value="DEL"/>
<xs:enumeration value="SEQ"/>
<xs:enumeration value="HMV"/>
<xs:enumeration value="HWYE"/>
<xs:enumeration value="HDEL"/>
<xs:enumeration value="SPC"/>
<xs:enumeration value="DPC"/>
<xs:enumeration value="INC"/>
<xs:enumeration value="ENC"/>
<xs:enumeration value="BSC"/>
<xs:enumeration value="ISC"/>
<xs:enumeration value="APC"/>
<xs:enumeration value="BAC"/>
<xs:enumeration value="SPG"/>
<xs:enumeration value="ING"/>
<xs:enumeration value="ENG"/>
<xs:enumeration value="ORG"/>
<xs:enumeration value="TSG"/>
<xs:enumeration value="CUG"/>
<xs:enumeration value="VSG"/>
<xs:enumeration value="ASG"/>
<xs:enumeration value="CURVE"/>
<xs:enumeration value="CSG"/>
<xs:enumeration value="DPL"/>
<xs:enumeration value="LPL"/>
<xs:enumeration value="CSD"/>
<xs:enumeration value="CST"/>
<xs:enumeration value="BTS"/>
<xs:enumeration value="UTS"/>
<xs:enumeration value="LTS"/>
<xs:enumeration value="GTS"/>
<xs:enumeration value="MTS"/>
<xs:enumeration value="NTS"/>
<xs:enumeration value="STS"/>
<xs:enumeration value="CTS"/>
<xs:enumeration value="OTS"/>
```

```
<xs:enumeration value="VSD"/>
<xs:enumeration value="ORS"/>
<xs:enumeration value="TCS"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tExtensionCDCEnum">
    <xs:restriction base="xs:Name">
        <xs:minLength value="1"/>
        <xs:maxLength value="5"/>
        <xs:pattern value="[A-Za-z]+"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tCDCEnum">
    <xs:restriction base="tPredefinedCDCEnum"/>
</xs:simpleType>
<xs:simpleType name="tFCEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="ST"/>
        <xs:enumeration value="MX"/>
        <xs:enumeration value="CO"/>
        <xs:enumeration value="SP"/>
        <xs:enumeration value="SG"/>
        <xs:enumeration value="SE"/>
        <xs:enumeration value="SV"/>
        <xs:enumeration value="CF"/>
        <xs:enumeration value="DC"/>
        <xs:enumeration value="EX"/>
        <xs:enumeration value="SR"/>
        <xs:enumeration value="BL"/>
        <xs:enumeration value="OR"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPredefinedBasicTypeEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="BOOLEAN"/>
        <xs:enumeration value="INT8"/>
        <xs:enumeration value="INT16"/>
        <xs:enumeration value="INT24"/>
        <xs:enumeration value="INT32"/>
```

```
<xs:enumeration value="INT64"/>
<xs:enumeration value="INT128"/>
<xs:enumeration value="INT8U"/>
<xs:enumeration value="INT16U"/>
<xs:enumeration value="INT24U"/>
<xs:enumeration value="INT32U"/>
<xs:enumeration value="FLOAT32"/>
<xs:enumeration value="FLOAT64"/>
<xs:enumeration value="Enum"/>
<xs:enumeration value="Dbpos"/>
<xs:enumeration value="Tcmd"/>
<xs:enumeration value="Quality"/>
<xs:enumeration value="Timestamp"/>
<xs:enumeration value="VisString32"/>
<xs:enumeration value="VisString64"/>
<xs:enumeration value="VisString65"/>
<xs:enumeration value="VisString129"/>
<xs:enumeration value="VisString255"/>
<xs:enumeration value="Octet64"/>
<xs:enumeration value="Unicode255"/>
<xs:enumeration value="Struct"/>
<xs:enumeration value="EntryTime"/>
<xs:enumeration value="Check"/>
<xs:enumeration value="ObjRef"/>
<xs:enumeration value="Currency"/>
<xs:enumeration value="PhyComAddr"/>
<xs:enumeration value="TrgOps"/>
<xs:enumeration value="OptFlds"/>
<xs:enumeration value="SvOptFlds"/>
<xs:enumeration value="LogOptFlds"/>
<xs:enumeration value="EntryID"/>
<xs:enumeration value="Octet6"/>
<xs:enumeration value="Octet16"/>
<!-- for 61850-8-1 Edition 2.1 -->
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tBasicTypeEnum">
    <xs:restriction base="tPredefinedBasicTypeEnum"/>
</xs:simpleType>
<xs:simpleType name="tValKindEnum">
```

```
<xs:restriction base="xs:Name">
    <xs:enumeration value="Spec"/>
    <xs:enumeration value="Conf"/>
    <xs:enumeration value="RO"/>
    <xs:enumeration value="Set"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tGSEControlTypeEnum">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="GSSE"/>
        <xs:enumeration value="GOOSE"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tUnitMultiplierEnum">
    <xs:restriction base="xs:normalizedString">
        <xs:enumeration value=""/>
        <xs:enumeration value="m"/>
        <xs:enumeration value="k"/>
        <xs:enumeration value="M"/>
        <xs:enumeration value="mu"/>
        <xs:enumeration value="y"/>
        <xs:enumeration value="z"/>
        <xs:enumeration value="a"/>
        <xs:enumeration value="f"/>
        <xs:enumeration value="p"/>
        <xs:enumeration value="n"/>
        <xs:enumeration value="c"/>
        <xs:enumeration value="d"/>
        <xs:enumeration value="da"/>
        <xs:enumeration value="h"/>
        <xs:enumeration value="G"/>
        <xs:enumeration value="T"/>
        <xs:enumeration value="P"/>
        <xs:enumeration value="E"/>
        <xs:enumeration value="Z"/>
        <xs:enumeration value="Y"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tRightEnum">
```

```
<xs:restriction base="xs:normalizedString">
    <xs:enumeration value="full"/>
    <xs:enumeration value="fix"/>
    <xs:enumeration value="dataflow"/>
</xs:restriction>
</xs:simpleType>
<xs:simpleType name="tSDOCount">
    <xs:union memberTypes="xs:unsignedInt tRestrName1stL"/>
</xs:simpleType>
<xs:simpleType name="tDItemCount">
    <xs:union memberTypes="xs:unsignedInt tAttributeNameEnum"/>
</xs:simpleType>
<xs:simpleType name="tSmpMod">
    <xs:restriction base="xs:normalizedString">
        <xs:enumeration value="SmpPerPeriod"/>
        <xs:enumeration value="SmpPerSec"/>
        <xs:enumeration value="SecPerSmp"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPredefinedPhysConnTypeEnum">
    <xs:restriction base="xs:normalizedString">
        <xs:enumeration value="Connection"/>
        <xs:enumeration value="RedConn"/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tExtensionPhysConnTypeEnum">
    <xs:restriction base="xs:normalizedString">
        <xs:pattern value="[A-Z][0-9A-Za-z\-*]*/>
    </xs:restriction>
</xs:simpleType>
<xs:simpleType name="tPhysConnTypeEnum">
    <xs:union memberTypes="tPredefinedPhysConnTypeEnum tExtensionPhysConnTypeEnum"/>
</xs:simpleType>
<xs:simpleType name="tServiceType">
    <xs:restriction base="xs:Name">
        <xs:enumeration value="Poll"/>
        <xs:enumeration value="Report"/>
        <xs:enumeration value="GOOSE"/>
        <xs:enumeration value="SMV"/>
    </xs:restriction>
```

```
</xs:simpleType>
<xs:simpleType name="tPredefinedTypeOfSecurityEnum">
    <xs:restriction base="xs:normalizedString">
        <xs:enumeration value="None"/>
        <xs:enumeration value="Signature"/>
        <xs:enumeration value="SignatureAndEncryption"/>
    </xs:restriction>
</xs:simpleType>
</xs:schema>
```

- File **SCL\_BaseTypes.xsd** :

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:scl="http://www.iec.ch/61850/2003/SCL" xmlns="http://www.iec.ch/61850/2003/SCL"
    xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.
            COPYRIGHT (c) IEC, 2016. All rights reserved. Disclaimer: The IEC disclaims liability for any
            personal injury, property or other damages of any nature whatsoever, whether special, indirect,
            consequential or compensatory,
            directly or indirectly resulting from this software and the document upon which its methods are
            based, use of, or reliance upon.
        </xs:documentation>
    </xs:annotation>
    <xs:include schemaLocation="SCL.Enums.xsd"/>
    <xs:attributeGroup name="agDesc">
        <xs:attribute name="desc" type="xs:normalizedString" use="optional" default="" />
    </xs:attributeGroup>
    <xs:complexType name="tBaseElement" abstract="true">
        <xs:sequence>
            <xs:any namespace="##other" processContents="lax" minOccurs="0"
                maxOccurs="unbounded"/>
            <xs:element name="Text" type="tText" minOccurs="0" />
            <xs:element name="Private" type="tPrivate" minOccurs="0" maxOccurs="unbounded" />
        </xs:sequence>
        <xs:anyAttribute namespace="##other" processContents="lax" />
    </xs:complexType>
</xs:schema>
```

```

</xs:complexType>
<xs:complexType name="tUnNaming" abstract="true">
    <xs:complexContent>
        <xs:extension base="tBaseElement">
            <xs:attributeGroup ref="agDesc"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tNaming" abstract="true">
    <xs:complexContent>
        <xs:extension base="tBaseElement">
            <xs:attribute name="name" type="tName" use="required"/>
            <xs:attributeGroup ref="agDesc"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tIDNaming" abstract="true">
    <xs:complexContent>
        <xs:extension base="tBaseElement">
            <xs:attribute name="id" type="tID" use="required"/>
            <xs:attributeGroup ref="agDesc"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tAnyContentFromOtherNamespace" abstract="true" mixed="true">
    <xs:sequence minOccurs="0" maxOccurs="unbounded">
        <xs:any namespace="#other" processContents="lax"/>
    </xs:sequence>
    <xs:anyAttribute namespace="#other" processContents="lax"/>
</xs:complexType>
<xs:complexType name="tText" mixed="true">
    <xs:complexContent>
        <xs:extension base="tAnyContentFromOtherNamespace">
            <xs:attribute name="source" type="xs:anyURI" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tPrivate" mixed="true">
    <xs:complexContent>
        <xs:extension base="tAnyContentFromOtherNamespace">

```

```
<xs:attribute name="type" use="required">
    <xs:simpleType>
        <xs:restriction base="xs:normalizedString">
            <xs:minLength value="1"/>
        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="source" type="xs:anyURI" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tHeader">
    <xs:sequence>
        <xs:element name="Text" type="tText" minOccurs="0"/>
        <xs:element name="History" minOccurs="0">
            <xs:complexType>
                <xs:sequence>
                    <xs:element name="Hitem" type="tHitem"
                        maxOccurs="unbounded"/>
                </xs:sequence>
            </xs:complexType>
        </xs:element>
    </xs:sequence>
    <xs:attribute name="id" type="xs:normalizedString" use="required"/>
    <xs:attribute name="version" type="xs:normalizedString" use="optional"/>
    <xs:attribute name="revision" type="xs:normalizedString" use="optional" default="" />
    <xs:attribute name="toolID" type="xs:normalizedString" use="optional"/>
    <xs:attribute name="nameStructure" use="optional" default="IEDName">
        <xs:simpleType>
            <xs:restriction base="xs:Name">
                <xs:enumeration value="IEDName"/>
            </xs:restriction>
        </xs:simpleType>
    </xs:attribute>
</xs:complexType>
<xs:complexType name="tHitem" mixed="true">
    <xs:complexContent>
        <xs:extension base="tAnyContentFromOtherNamespace">
            <xs:attribute name="version" type="xs:normalizedString" use="required"/>
```

```
<xs:attribute name="revision" type="xs:normalizedString" use="required"/>
<xs:attribute name="when" type="xs:normalizedString" use="required"/>
<xs:attribute name="who" type="xs:normalizedString"/>
<xs:attribute name="what" type="xs:normalizedString"/>
<xs:attribute name="why" type="xs:normalizedString"/>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tVal">
    <xs:simpleContent>
        <xs:extension base="xs:normalizedString">
            <xs:attribute name="sGroup" type="xs:unsignedInt" use="optional"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tValueWithUnit">
    <xs:simpleContent>
        <xs:extension base="xs:decimal">
            <xs:attribute name="unit" type="xs:token" use="required"/>
            <xs:attribute name="multiplier" type="tUnitMultiplierEnum" use="optional"
                default="" />
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tVoltage">
    <xs:simpleContent>
        <xs:restriction base="tValueWithUnit">
            <xs:attribute name="unit" type="xs:token" use="required" fixed="V"/>
            <xs:attribute name="multiplier" type="tUnitMultiplierEnum" use="optional"
                default="" />
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tDurationInSec">
    <xs:simpleContent>
        <xs:restriction base="tValueWithUnit">
            <xs:attribute name="unit" type="xs:token" use="required" fixed="s"/>
            <xs:attribute name="multiplier" type="tUnitMultiplierEnum" use="optional"
                default="" />
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
```

```
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tDurationInMilliSec">
    <xs:simpleContent>
        <xs:extension base="xs:decimal">
            <xs:attribute name="unit" type="xs:token" use="optional" fixed="s"/>
            <xs:attribute name="multiplier" type="tUnitMultiplierEnum" use="optional"
                fixed="m"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tBitRateInMbPerSec">
    <xs:simpleContent>
        <xs:extension base="xs:decimal">
            <xs:attribute name="unit" type="xs:normalizedString" use="optional" fixed="b/s"/>
            <xs:attribute name="multiplier" type="tUnitMultiplierEnum" use="optional"
                fixed="M"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
</xs:schema>
```

**b) Substation syntax (SCL\_Substation.xsd)**

- File **SCL\_Substation.xsd** :

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:scl="http://www.iec.ch/61850/2003/SCL" xmlns="http://www.iec.ch/61850/2003/SCL"
    xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.
            COPYRIGHT (c) IEC, 2016. All rights reserved. Disclaimer: The IEC disclaims liability for any
            personal injury,
            property or other damages of any nature whatsoever, whether special, indirect, consequential or
            compensatory, directly or
            indirectly resulting from this software and the document upon which its methods are based, use of,
            or reliance upon.
        </xs:documentation>
    </xs:annotation>
```

```

</xs:annotation>
<xs:include schemaLocation="SCL_BaseTypes.xsd"/>
<xs:attributeGroup name="agVirtual">
    <xs:attribute name="virtual" type="xs:boolean" use="optional" default="false"/>
</xs:attributeGroup>
<xs:complexType name="tLNNodeContainer" abstract="true">
    <xs:complexContent>
        <xs:extension base="tNaming">
            <xs:sequence>
                <xs:element name="LNode" type="tLNNode" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tPowerSystemResource" abstract="true">
    <xs:complexContent>
        <xs:extension base="tLNNodeContainer"/>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tEquipmentContainer" abstract="true">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
            <xs:sequence>
                <xs:element name="PowerTransformer" type="tPowerTransformer" minOccurs="0"
                           maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInPowerTransformer">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@ldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                    <xs:unique name="uniqueChildNameInPTR">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="GeneralEquipment" type="tGeneralEquipment" minOccurs="0"
                           maxOccurs="unbounded">

```

```
<xs:unique name="uniqueLNodeInGeneralEquipment">
    <xs:selector xpath=".//scl:LNode"/>
    <xs:field xpath="@lnInst"/>
    <xs:field xpath="@lnClass"/>
    <xs:field xpath="@iedName"/>
    <xs:field xpath="@ldInst"/>
    <xs:field xpath="@prefix"/>
</xs:unique>
<xs:unique name="uniqueChildNameInGE">
    <xs:selector xpath="./*"/>
    <xs:field xpath="@name"/>
</xs:unique>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tEquipment" abstract="true">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
            <xs:attributeGroup ref="agVirtual"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tAbstractConductingEquipment" abstract="true">
    <xs:complexContent>
        <xs:extension base="tEquipment">
            <xs:sequence>
                <xs:element name="Terminal" type="tTerminal" minOccurs="0" maxOccurs="2"/>
                <xs:element name="SubEquipment" type="tSubEquipment" minOccurs="0"
maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInSubEquipment">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@ldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>

```

```

                <xs:unique name="uniqueChildNameInACESubEquipment">
                    <xs:selector xpath="./*"/>
                    <xs:field xpath="@name"/>
                </xs:unique>
            </xs:element>
        </xs:sequence>
    </xs:extension>
</xs:complexContent>
<xs:complexType name="tConductingEquipment">
    <xs:complexContent>
        <xs:extension base="tAbstractConductingEquipment">
            <xs:sequence>
                <xs:element name="EqFunction" type="scl:tEqFunction" minOccurs="0"
maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInFuncForCE">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@oldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                    <xs:unique name="uniqueChildNameInFuncForCE">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                </xs:element>
            </xs:sequence>
            <xs:attribute name="type" type="tCommonConductingEquipmentEnum" use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSubEquipment">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
            <xs:sequence>
                <xs:element name="EqFunction" type="scl:tEqFunction" minOccurs="0"
maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInFuncForSubEq">

```

```
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueChildNameInFuncForSubEq">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
</xs:sequence>
<xs:attribute name="phase" type="tPhaseEnum" use="optional" default="none"/>
<xs:attributeGroup ref="agVirtual"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tPowerTransformer">
    <xs:complexContent>
        <xs:extension base="tEquipment">
            <xs:sequence>
                <xs:element name="TransformerWinding" type="tTransformerWinding"
maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInTransformerWinding">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@ldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                    <xs:unique name="uniqueChildNameInPTW">
                        <xs:selector
xpath=".//scl:SubEquipment|./scl:TapChanger|./scl:EqFunction"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="SubEquipment" type="scl:tSubEquipment" minOccurs="0"
```

```

maxOccurs="unbounded">
    <xs:unique name="uniqueLNodeInSubEquipmentPTR">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueChildNameInPTRSubEquipment">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
<xs:element name="EqFunction" type="scl:tEqFunction" minOccurs="0">
    maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInFuncForPTR">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueChildNameInFuncForPTR">
            <xs:selector xpath="./*"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
</xs:sequence>
<xs:attribute name="type" type="tPowerTransformerEnum" use="required" fixed="PTR"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tTransformerWinding">
    <xs:complexContent>
        <xs:extension base="tAbstractConductingEquipment">
            <xs:sequence>
                <xs:element name="TapChanger" type="tTapChanger" minOccurs="0">
                    <xs:unique name="uniqueLNodeInTapChanger">

```

```
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueChildNameInLTC">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
<xs:element name="NeutralPoint" type="tTerminal" minOccurs="0"/>
<xs:element name="EqFunction" type="scl:tEqFunction" minOccurs="0"
maxOccurs="unbounded">
    <xs:unique name="uniqueLNodeInFuncForPTW">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueChildNameInFuncForPTW">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
</xs:sequence>
<xs:attribute name="type" type="tTransformerWindingEnum" use="required" fixed="PTW"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tTapChanger">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
            <xs:sequence>
                <xs:element name="SubEquipment" type="scl:tSubEquipment" minOccurs="0"
maxOccurs="unbounded">
```

```

        <xs:unique name="uniqueLNodeInSubEquipmentLTC">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueChildNameInLTCSubEquipment">
            <xs:selector xpath="./*"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
    <xs:element name="EqFunction" type="scl:tEqFunction" minOccurs="0"
maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInFuncForLTC">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueChildNameInFuncForLTC">
            <xs:selector xpath="./*"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
</xs:sequence>
<xs:attribute name="type" type="xs:Name" use="required" fixed="LTC"/>
<xs:attributeGroup ref="agVirtual"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tGeneralEquipment">
    <xs:complexContent>
        <xs:extension base="tEquipment">
            <xs:sequence>
                <xs:element name="EqFunction" type="scl:tEqFunction" minOccurs="0"
maxOccurs="unbounded">

```

```
<xs:unique name="uniqueLNodeInFuncForGE">
    <xs:selector xpath=".//scl:LNode"/>
    <xs:field xpath="@lnInst"/>
    <xs:field xpath="@lnClass"/>
    <xs:field xpath="@iedName"/>
    <xs:field xpath="@ldInst"/>
    <xs:field xpath="@prefix"/>
</xs:unique>
<xs:unique name="uniqueChildNameInFuncForGE">
    <xs:selector xpath="./*"/>
    <xs:field xpath="@name"/>
</xs:unique>
</xs:element>
</xs:sequence>
<xs:attribute name="type" type="tGeneralEquipmentEnum" use="required"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tSubstation">
    <xs:complexContent>
        <xs:extension base="tEquipmentContainer">
            <xs:sequence>
                <xs:element name="VoltageLevel" type="tVoltageLevel" maxOccurs="unbounded">
                    <xs:unique name="uniqueChildNameInVoltageLevel">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                    <xs:unique name="uniqueLNodeInVoltageLevel">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@ldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="Function" type="tFunction" minOccurs="0" maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInFunctionSS">
                        <xs:selector xpath=".//scl:LNode"/>

```

```

        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@oldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueChildNameInSubstationFunc">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tVoltageLevel">
    <xs:complexContent>
        <xs:extension base="tEquipmentContainer">
            <xs:sequence>
                <xs:element name="Voltage" type="tVoltage" minOccurs="0"/>
                <xs:element name="Bay" type="tBay" maxOccurs="unbounded">
                    <xs:unique name="uniqueChildNameInBay">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                    <xs:unique name="uniqueLNodeInBay">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@oldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="Function" type="scl:tFunction" minOccurs="0" maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInFunctionVL">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>

```

```
        <xs:field xpath="@oldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueChildNameInVoltageLevelFunc">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
</xs:sequence>
<xs:attribute name="nomFreq" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:decimal">
            <xs:minInclusive value="0"/>
        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="numPhases" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedByte">
            <xs:minExclusive value="0"/>
        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tBay">
    <xs:complexContent>
        <xs:extension base="tEquipmentContainer">
            <xs:sequence>
                <xs:element name="ConductingEquipment" type="tConductingEquipment" minOccurs="0"
maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInConductingEquipment">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@oldInst"/>
                        <xs:field xpath="@prefix"/>

```

```

        </xs:unique>
        <xs:unique name="uniqueChildNameInCE">
            <xs:selector xpath=".//scl:SubEquipment|./scl:EqFunction"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
    <xs:element name="ConnectivityNode" type="tConnectivityNode" minOccurs="0"
               maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInConnectivityNode">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
    </xs:element>
    <xs:element name="Function" type="scl:tFunction" minOccurs="0" maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInFunctionB">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueChildNameInBayFunc">
            <xs:selector xpath=".*"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
</xs:sequence>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tLNode">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="iedName" type="tIEDNameOrNone" use="optional" default="None"/>
            <xs:attribute name="ldInst" type="tLDInstOrEmpty" use="optional" default="" />

```

```

<xs:attribute name="prefix" type="tPrefix" use="optional" default="" />
<xs:attribute name="lnClass" type="tLNClassEnum" use="required" />
<xs:attribute name="lnInst" type="tLNInstOrEmpty" use="optional" default="" />
<xs:attribute name="lnType" type="tName" use="optional" />
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tFunction">
<xs:complexContent>
<xs:extension base="tPowerSystemResource">
<xs:sequence>
<xs:element name="SubFunction" type="tSubFunction" minOccurs="0"
maxOccurs="unbounded">
<xs:unique name="uniqueLNodeInSubFunction">
<xs:selector xpath=".//scl:LNode"/>
<xs:field xpath="@lnInst"/>
<xs:field xpath="@lnClass"/>
<xs:field xpath="@iedName"/>
<xs:field xpath="@ldInst"/>
<xs:field xpath="@prefix"/>
</xs:unique>
<xs:unique name="uniqueChildNameInSubFunc">
<xs:selector xpath="./*"/>
<xs:field xpath="@name"/>
</xs:unique>
</xs:element>
<xs:element name="GeneralEquipment" type="tGeneralEquipment" minOccurs="0"
maxOccurs="unbounded">
<xs:unique name="uniqueLNodeInGeneralEquipmentOfFunction">
<xs:selector xpath=".//scl:LNode"/>
<xs:field xpath="@lnInst"/>
<xs:field xpath="@lnClass"/>
<xs:field xpath="@iedName"/>
<xs:field xpath="@ldInst"/>
<xs:field xpath="@prefix"/>
</xs:unique>
<xs:unique name="uniqueChildNameInGEFunc">
<xs:selector xpath="./*"/>
<xs:field xpath="@name"/>

```

```

        </xs:unique>
    </xs:element>
    <xs:element name="ConductingEquipment" type="tConductingEquipment" minOccurs="0"
               maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInConductingEquipmentOfFunction">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueChildNameInCondEq">
            <xs:selector xpath=".//scl:SubEquipment|.//scl:EqFunction"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
</xs:sequence>
<xs:attribute name="type" type="xs:normalizedString" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tSubFunction">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
            <xs:sequence>
                <xs:element name="GeneralEquipment" type="tGeneralEquipment" minOccurs="0"
                           maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInGeneralEquipmentOfSubFunction">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@ldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                    <xs:unique name="uniqueChildNameInGESubFunc">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                </xs:element>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

```

```
</xs:element>
<xs:element name="ConductingEquipment" type="scl:tConductingEquipment" minOccurs="0"
    maxOccurs="unbounded">
    <xs:unique name="uniqueLNodeInConductingEquipmentOfSubFunction">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueSubEquipmentSubFunc">
        <xs:selector xpath=".//scl:SubEquipment"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
<xs:element name="SubFunction" type="scl:tSubFunction" minOccurs="0"
    maxOccurs="unbounded">
    <xs:unique name="uniqueLNodeInSubSubFunction">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
    <xs:unique name="uniqueSubSubFunc">
        <xs:selector xpath=".//scl:SubFunction"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
</xs:sequence>
<xs:attribute name="type" type="xs:normalizedString" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tAbstractEqFuncSubFunc" abstract="true">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
```

```

<xs:sequence>
    <xs:element name="GeneralEquipment" type="tGeneralEquipment" minOccurs="0"
        maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInGeneralEquipmentOfFuncForEquipment">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueChildNameInGEFuncForEquipment">
            <xs:selector xpath="./*"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
    <xs:element name="EqSubFunction" type="scl:tEqSubFunction" minOccurs="0"
        maxOccurs="unbounded">
        <xs:unique name="uniqueLNodeInSubFuncForEquipment">
            <xs:selector xpath=".//scl:LNode"/>
            <xs:field xpath="@lnInst"/>
            <xs:field xpath="@lnClass"/>
            <xs:field xpath="@iedName"/>
            <xs:field xpath="@ldInst"/>
            <xs:field xpath="@prefix"/>
        </xs:unique>
        <xs:unique name="uniqueSubFuncForEquipment">
            <xs:selector xpath=".//scl:EqSubFunction"/>
            <xs:field xpath="@name"/>
        </xs:unique>
    </xs:element>
</xs:sequence>
<xs:attribute name="type" type="xs:normalizedString" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tEqFunction">
    <xs:complexContent>
        <xs:extension base="tAbstractEqFuncSubFunc"/>
    </xs:complexContent>

```

```
</xs:complexType>
<xs:complexType name="tEqSubFunction">
    <xs:complexContent>
        <xs:extension base="tAbstractEqFuncSubFunc"/>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tConnectivityNode">
    <xs:complexContent>
        <xs:extension base="tLNNodeContainer">
            <xs:attribute name="pathName" type="tConnectivityNodeReference" use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tTerminal">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="name" type="tAnyName" use="optional" default="" />
            <xs:attribute name="connectivityNode" type="tConnectivityNodeReference" use="required"/>
            <xs:attribute name="processName" type="tProcessName" use="optional"/>
            <xs:attribute name="substationName" type="tName" use="optional"/>
            <xs:attribute name="voltageLevelName" type="tName" use="optional"/>
            <xs:attribute name="bayName" type="tName" use="optional"/>
            <xs:attribute name="cNodeName" type="tName" use="required"/>
            <xs:attribute name="lineName" type="tName" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tGeneralEquipmentContainer" abstract="true">
    <xs:complexContent>
        <xs:extension base="tPowerSystemResource">
            <xs:sequence>
                <xs:element name="GeneralEquipment" type="tGeneralEquipment" minOccurs="0"
                           maxOccurs="unbounded">
                    <xs:unique name="uniqueLNodeInGeneralEquipment2">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@oldInst"/>

```

```

                <xs:field xpath="@prefix"/>
            </xs:unique>
            <xs:unique name="uniqueChildNameInGE2">
                <xs:selector xpath="./*"/>
                <xs:field xpath="@name"/>
            </xs:unique>
        </xs:element>
        <xs:element name="Function" type="tFunction" minOccurs="0" maxOccurs="unbounded">
            <xs:unique name="uniqueLNodeInFunction">
                <xs:selector xpath=".//scl:LNode"/>
                <xs:field xpath="@lnInst"/>
                <xs:field xpath="@lnClass"/>
                <xs:field xpath="@iedName"/>
                <xs:field xpath="@ldInst"/>
                <xs:field xpath="@prefix"/>
            </xs:unique>
            <xs:unique name="uniqueChildNameInFunction">
                <xs:selector xpath="./*"/>
                <xs:field xpath="@name"/>
            </xs:unique>
        </xs:element>
    </xs:sequence>
</xs:complexType>
<xs:complexType name="tLine">
    <xs:complexContent>
        <xs:extension base="tGeneralEquipmentContainer">
            <xs:sequence>
                <xs:element name="Voltage" type="tVoltage" minOccurs="0"/>
                <xs:element name="ConductingEquipment" type="scl:tConductingEquipment"
maxOccurs="unbounded"/>
                <xs:element name="ConnectivityNode" type="scl:tConnectivityNode" minOccurs="0"
maxOccurs="unbounded"/>
            </xs:sequence>
            <xs:attribute name="type" type="tLineType" use="optional"/>
            <xs:attribute name="nomFreq" use="optional">
                <xs:simpleType>
                    <xs:restriction base="xs:decimal">
                        <xs:minInclusive value="0"/>

```

```
        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="numPhases" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedByte">
            <xs:minExclusive value="0"/>
        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tProcess">
    <xs:complexContent>
        <xs:extension base="tGeneralEquipmentContainer">
            <xs:sequence>
                <xs:element name="ConductingEquipment" type="scl:tConductingEquipment" minOccurs="0"
                           maxOccurs="unbounded"/>
                <xs:element name="Substation" type="tSubstation" minOccurs="0" maxOccurs="unbounded">
                    <xs:unique name="uniqueChildNameInProcessSubstation">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
                    <xs:unique name="uniqueLNodeInProcessSubstation">
                        <xs:selector xpath=".//scl:LNode"/>
                        <xs:field xpath="@lnInst"/>
                        <xs:field xpath="@lnClass"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@ldInst"/>
                        <xs:field xpath="@prefix"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="Line" type="tLine" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="Process" type="tProcess" minOccurs="0" maxOccurs="unbounded">
                    <xs:unique name="uniqueChildNameInSubProcess">
                        <xs:selector xpath="./*"/>
                        <xs:field xpath="@name"/>
                    </xs:unique>
```

```
<xs:unique name="uniqueLNodeInSubProcess">
    <xs:selector xpath=".//scl:LNode"/>
    <xs:field xpath="@lnInst"/>
    <xs:field xpath="@lnClass"/>
    <xs:field xpath="@iedName"/>
    <xs:field xpath="@ldInst"/>
    <xs:field xpath="@prefix"/>
</xs:unique>
</xs:element>
</xs:sequence>
<xs:attribute name="type" type="tProcessType" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:element name="Substation" type="tSubstation">
    <xs:unique name="uniqueChildNameInSubstation">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueLNodeInSubstation">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
</xs:element>
<xs:element name="Process" type="tProcess">
    <xs:unique name="uniqueChildNameInProcess">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueLNodeInProcess">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
</xs:element>
```

```
        </xs:unique>
    </xs:element>
<xs:element name="Line" type="tLine">
    <xs:unique name="uniqueChildNameInLine">
        <xs:selector xpath="./*"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueLNodeInLine">
        <xs:selector xpath=".//scl:LNode"/>
        <xs:field xpath="@lnInst"/>
        <xs:field xpath="@lnClass"/>
        <xs:field xpath="@iedName"/>
        <xs:field xpath="@ldInst"/>
        <xs:field xpath="@prefix"/>
    </xs:unique>
</xs:element>
</xs:schema>
```

### c) Data type templates (SCL\_DataTypeTemplates.xsd)

- File SCL\_DataTypeTemplates.xsd :

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:scl="http://www.iec.ch/61850/2003/SCL" xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns="http://www.iec.ch/61850/2003/SCL" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.
            COPYRIGHT (c) IEC, 2016. All rights reserved. Disclaimer: The IEC disclaims liability for any
personal injury,
            property or other damages of any nature whatsoever, whether special, indirect, consequential or
compensatory, directly or
            indirectly resulting from this software and the document upon which its methods are based, use of,
or reliance upon.
        </xs:documentation>
    </xs:annotation>
    <xs:include schemaLocation="SCL_BaseTypes.xsd"/>
    <xs:attributeGroup name="agDATrgOp">
        <xs:attribute name="dchg" type="xs:boolean" use="optional" default="false"/>
```

```

<xs:attribute name="qchg" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="dupd" type="xs:boolean" use="optional" default="false"/>
</xs:attributeGroup>
<xs:complexType name="tAbstractDataAttribute" abstract="true">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="Val" type="tVal" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
            <xs:attribute name="name" type="tAttributeNameEnum" use="required"/>
            <xs:attribute name="sAddr" type="xs:normalizedString" use="optional"/>
            <xs:attribute name="bType" type="tBasicTypeEnum" use="required"/>
            <xs:attribute name="valKind" type="tValKindEnum" use="optional" default="Set"/>
            <xs:attribute name="type" type="tAnyName" use="optional"/>
            <xs:attribute name="count" type="tDACount" use="optional" default="0"/>
            <xs:attribute name="valImport" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tLNNodeType">
    <xs:complexContent>
        <xs:extension base="tIDNaming">
            <xs:sequence>
                <xs:element name="DO" type="tDO" maxOccurs="unbounded"/>
            </xs:sequence>
            <xs:attribute name="iedType" type="tAnyName" use="optional" default="" />
            <xs:attribute name="lnClass" type="tLNClassEnum" use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tDO">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="name" type="tDataName" use="required"/>
            <xs:attribute name="type" type="tName" use="required"/>
            <xs:attribute name="accessControl" type="xs:normalizedString" use="optional"/>
            <xs:attribute name="transient" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

```

```
<xs:complexType name="tDOType">
    <xs:complexContent>
        <xs:extension base="tIDNaming">
            <xs:choice minOccurs="0" maxOccurs="unbounded">
                <xs:element name="SDO" type="tSDO"/>
                <xs:element name="DA" type="tDA">
                    <xs:unique name="uniqueProtNsInDA">
                        <xs:selector xpath="scl:ProtNs"/>
                        <xs:field xpath="@type"/>
                        <xs:field xpath=". "/>
                    </xs:unique>
                </xs:element>
            </xs:choice>
            <xs:attribute name="iedType" type="tAnyName" use="optional" default="" />
            <xs:attribute name="cdc" type="tCDCEnum" use="required" />
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSDO">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="name" type="tSubDataName" use="required" />
            <xs:attribute name="type" type="tName" use="required" />
            <xs:attribute name="count" type="tSDOCOUNT" use="optional" default="0" />
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tDA">
    <xs:complexContent>
        <xs:extension base="tAbstractDataAttribute">
            <xs:sequence>
                <xs:element name="ProtNs" type="tProtNs" minOccurs="0" maxOccurs="unbounded" />
            </xs:sequence>
            <xs:attributeGroup ref="agDATrgOp" />
            <xs:attribute name="fc" type="tFCEnum" use="required" />
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tDAType">
```

```

<xs:complexType>
    <xs:extension base="tIDNaming">
        <xs:sequence>
            <xs:element name="BDA" type="tBDA" maxOccurs="unbounded"/>
            <xs:element name="ProtNs" type="tProtNs" minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="iedType" type="tAnyName" use="optional" default="" />
    </xs:extension>
</xs:complexType>
<xs:complexType name="tBDA">
    <xs:complexContent>
        <xs:extension base="tAbstractDataAttribute"/>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tEnumType">
    <xs:complexContent>
        <xs:extension base="tIDNaming">
            <xs:sequence>
                <xs:element name="EnumVal" type="tEnumVal" maxOccurs="unbounded"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tProtNs">
    <xs:simpleContent>
        <xs:extension base="tNamespaceName">
            <xs:attribute name="type" use="optional" default="8-MMS">
                <xs:simpleType>
                    <xs:restriction base="xs:normalizedString">
                        <xs:minLength value="1"/>
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tEnumVal">
    <xs:simpleContent>
        <xs:extension base="tEnumStringValue">

```

```
        <xs:attribute name="ord" type="xs:int" use="required"/>
        <xs:attributeGroup ref="agDesc"/>
    </xs:extension>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tDataTypeTemplates">
    <xs:sequence>
        <xs:element name="LNodeType" type="tLNodeType" maxOccurs="unbounded">
            <xs:unique name="uniqueDOInLNodeType">
                <xs:selector xpath="scl:DO"/>
                <xs:field xpath="@name"/>
            </xs:unique>
        </xs:element>
        <xs:element name="DOType" type="tDOType" maxOccurs="unbounded">
            <xs:unique name="uniqueDAorSDOInDOType">
                <xs:selector xpath="./*"/>
                <xs:field xpath="@name"/>
            </xs:unique>
        </xs:element>
        <xs:element name="DAType" type="tDAType" minOccurs="0" maxOccurs="unbounded">
            <xs:unique name="uniqueBDAInDAType">
                <xs:selector xpath="scl:BDA"/>
                <xs:field xpath="@name"/>
            </xs:unique>
            <xs:unique name="uniqueProtNs">
                <xs:selector xpath="scl:ProtNs"/>
                <xs:field xpath="@type"/>
                <xs:field xpath=".."/>
            </xs:unique>
        </xs:element>
        <xs:element name="EnumType" type="tEnumType" minOccurs="0" maxOccurs="unbounded">
            <xs:unique name="uniqueOrdInEnumType">
                <xs:selector xpath="scl:EnumVal"/>
                <xs:field xpath="@ord"/>
            </xs:unique>
            <xs:unique name="uniqueEnumValue">
                <xs:selector xpath="scl:EnumVal"/>
                <xs:field xpath=".."/>
            </xs:unique>
```

```

        </xs:element>
    </xs:sequence>
</xs:complexType>
<xs:element name="DataTypeTemplates" type="tDataTypeTemplates">
    <xs:key name="DOTypeKey">
        <xs:selector xpath="scl:DOType"/>
        <xs:field xpath="@id"/>
    </xs:key>
    <xs:keyref name="ref2DOType" refer="DOTypeKey">
        <xs:selector xpath="scl:LNodeType/scl:DO"/>
        <xs:field xpath="@type"/>
    </xs:keyref>
    <xs:keyref name="ref2DOTypeForSDO" refer="DOTypeKey">
        <xs:selector xpath="scl:DOType/scl:SDO"/>
        <xs:field xpath="@type"/>
    </xs:keyref>
    <xs:unique name="uniqueDTT_ID">
        <xs:selector xpath="*"/>
        <xs:field xpath="@id"/>
    </xs:unique>
    <xs:key name="EnumTypeDATypeKey">
        <xs:selector xpath="scl:DAType | scl:EnumType"/>
        <xs:field xpath="@id"/>
    </xs:key>
    <xs:keyref name="ref2EnumTypeDAType" refer="scl:EnumTypeDATypeKey">
        <xs:selector xpath="scl:DOType/scl:DA | scl:DAType/scl:BDA"/>
        <xs:field xpath="@type"/>
    </xs:keyref>
</xs:element>
</xs:schema>
```

#### d) IED capabilities and structure (SCL\_IED.xsd)

- File SCL\_IED.xsd :

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:scl="http://www.iec.ch/61850/2003/SCL" xmlns="http://www.iec.ch/61850/2003/SCL"
    xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
```

SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.  
COPYRIGHT (c) IEC, 2016. All rights reserved. Disclaimer: The IEC disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from this software and the document upon which its methods are based, use of, or reliance upon.

```
</xs:documentation>
</xs:annotation>
<xs:include schemaLocation="SCL_BaseTypes.xsd"/>
<xs:attributeGroup name="agAuthentication">
    <xs:attribute name="none" type="xs:boolean" use="optional" default="true"/>
    <xs:attribute name="password" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="weak" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="strong" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="certificate" type="xs:boolean" use="optional" default="false"/>
</xs:attributeGroup>
<xs:attributeGroup name="agSmvOpts">
    <xs:attribute name="refreshTime" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="sampleSynchronized" type="xs:boolean" use="optional" fixed="true"/>
    <xs:attribute name="sampleRate" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="dataSet" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="security" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="timestamp" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="synchSourceId" type="xs:boolean" use="optional" default="false"/>
</xs:attributeGroup>
<xs:attributeGroup name="agOptFields">
    <xs:attribute name="seqNum" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="timeStamp" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="dataSet" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="reasonCode" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="dataRef" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="entryID" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="configRef" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="bufOvfl" type="xs:boolean" use="optional" default="true"/>
</xs:attributeGroup>
<xs:attributeGroup name="agLDRef">
    <xs:attributeGroup ref="scl:agDesc"/>
    <xs:attribute name="iedName" type="tIEDName" use="required"/>
```

```

<xs:attribute name="ldInst" type="tLDInst" use="required"/>
</xs:attributeGroup>
<xs:attributeGroup name="agLNRef">
    <xs:attributeGroup ref="agLDRef"/>
    <xs:attribute name="prefix" type="tPrefix" use="optional" default="" />
    <xs:attribute name="lnClass" type="tLNClassEnum" use="required" />
    <xs:attribute name="lnInst" type="tLNInstOrEmpty" use="required" />
</xs:attributeGroup>
<xs:complexType name="tIED">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="Services" type="tServices" minOccurs="0" />
                <xs:element name="AccessPoint" type="tAccessPoint" maxOccurs="unbounded" >
                    <xs:unique name="uniqueLNInAccessPoint">
                        <xs:selector xpath=".//scl:LN" />
                        <xs:field xpath="@inst" />
                        <xs:field xpath="@lnClass" />
                        <xs:field xpath="@prefix" />
                    </xs:unique>
                </xs:element>
                <xs:element name="KDC" type="tKDC" minOccurs="0" maxOccurs="unbounded" />
            </xs:sequence>
            <xs:attribute name="name" type="tIEDName" use="required" />
            <xs:attribute name="type" type="xs:normalizedString" use="optional" />
            <xs:attribute name="manufacturer" type="xs:normalizedString" use="optional" />
            <xs:attribute name="configVersion" type="xs:normalizedString" use="optional" />
            <xs:attribute name="originalSclVersion" type="tSclVersion" use="optional" default="2003" />
            <xs:attribute name="originalSclRevision" type="tSclRevision" use="optional" default="A" />
            <xs:attribute name="originalSclRelease" type="tSclRelease" use="optional" default="1" />
            <xs:attribute name="engRight" type="tRightEnum" use="optional" default="full" />
            <xs:attribute name="owner" type="xs:normalizedString" use="optional" />
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tServices">
    <xs:all>
        <xs:element name="DynAssociation" type="scl:tServiceWithOptionalMax" minOccurs="0" />
        <xs:element name="SettingGroups" type="scl:tSettingGroups" minOccurs="0" />
        <xs:element name="GetDirectory" type="scl:tServiceYesNo" minOccurs="0" />
    </xs:all>
</xs:complexType>

```

```
<xs:element name="GetDataObjectDefinition" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="DataObjectDirectory" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="GetDataSetValue" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="SetDataSetValue" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="DataSetDirectory" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="ConfDataSet" type="scl:tServiceForConfDataSet" minOccurs="0"/>
<xs:element name="DynDataSet" type="scl:tServiceWithMaxAndMaxAttributes" minOccurs="0"/>
<xs:element name="ReadWrite" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="TimerActivatedControl" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="ConfReportControl" type="scl:tServiceConfReportControl" minOccurs="0"/>
<xs:element name="GetCBValues" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="ConfLogControl" type="scl:tServiceWithMaxNonZero" minOccurs="0"/>
<xs:element name="ReportSettings" type="scl:tReportSettings" minOccurs="0"/>
<xs:element name="LogSettings" type="scl:tLogSettings" minOccurs="0"/>
<xs:element name="GSESettings" type="scl:tGSESettings" minOccurs="0"/>
<xs:element name="SMVSettings" type="scl:tSMVSettings" minOccurs="0"/>
<xs:element name="GSEDir" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="GOOSE" type="scl:tGOOSEcapabilities" minOccurs="0"/>
<xs:element name="GSSE" type="scl:tServiceWithMax" minOccurs="0"/>
<xs:element name="SMVsc" type="scl:tSMVsc" minOccurs="0"/>
<xs:element name="FileHandling" type="scl:tFileHandling" minOccurs="0"/>
<xs:element name="ConfLNs" type="scl:tConfLNs" minOccurs="0"/>
<xs:element name="ClientServices" type="scl:tClientServices" minOccurs="0"/>
<xs:element name="ConfLdName" type="scl:tServiceYesNo" minOccurs="0"/>
<xs:element name="SupSubscription" type="scl:tSupSubscription" minOccurs="0"/>
<xs:element name="ConfSigRef" type="scl:tServiceWithMaxNonZero" minOccurs="0"/>
<xs:element name="ValueHandling" type="scl:tValueHandling" minOccurs="0"/>
<xs:element name="RedProt" type="scl:tRedProt" minOccurs="0"/>
<xs:element name="TimeSyncProt" type="scl:tTimeSyncProt" minOccurs="0"/>
<xs:element name="CommProt" type="scl:tCommProt" minOccurs="0"/>
</xs:all>
<xs:attribute name="nameLength" use="optional" default="32">
  <xs:simpleType>
    <xs:restriction base="xs:token">
      <xs:pattern value="32"/>
      <xs:pattern value="64"/>
      <xs:pattern value="6[5-9]"/>
      <xs:pattern value="[7-9]\d"/>
      <xs:pattern value="[1-9]\d\d+"/>
    
```

```

        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
</xs:complexType>
<xs:complexType name="tAccessPoint">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:choice minOccurs="0">
                    <xs:element name="Server" type="scl:tServer">
                        <xs:unique name="uniqueAssociationInServer">
                            <xs:selector xpath=".//scl:Association"/>
                            <xs:field xpath="@associationID"/>
                        </xs:unique>
                    </xs:element>
                    <xs:element ref="scl:LN" maxOccurs="unbounded"/>
                    <xs:element name="ServerAt" type="tServerAt"/>
                </xs:choice>
                <xs:element name="Services" type="scl:tServices" minOccurs="0"/>
                <xs:element name="GOOSESecurity" type="tCertificate" minOccurs="0" maxOccurs="7"/>
                <xs:element name="SMVSecurity" type="tCertificate" minOccurs="0" maxOccurs="7"/>
            </xs:sequence>
            <xs:attribute name="name" type="tAccessPointName" use="required"/>
            <xs:attribute name="router" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="clock" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="kdc" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tCertificate">
    <xs:complexContent>
        <xs:extension base="tNaming">
            <xs:sequence>
                <xs:element name="Subject" type="tCert"/>
                <xs:element name="IssuerName" type="tCert"/>
            </xs:sequence>
            <xs:attribute name="xferNumber" type="xs:unsignedInt" use="optional"/>
            <xs:attribute name="serialNumber" use="required">
                <xs:simpleType>
                    <xs:restriction base="xs:normalizedString">

```

```
        <xs:minLength value="1"/>
        <xs:pattern value="[0-9]+"/>
    </xs:restriction>
</xs:simpleType>
</xs:attribute>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tCert">
    <xs:attribute name="commonName" use="required">
        <xs:simpleType>
            <xs:restriction base="xs:normalizedString">
                <xs:minLength value="4"/>
                <xs:pattern value="none"/>
                <xs:pattern value="CN=.+/">
            </xs:restriction>
        </xs:simpleType>
    </xs:attribute>
    <xs:attribute name="idHierarchy" use="required">
        <xs:simpleType>
            <xs:restriction base="xs:normalizedString">
                <xs:minLength value="1"/>
            </xs:restriction>
        </xs:simpleType>
    </xs:attribute>
</xs:complexType>
<xs:complexType name="tServerAt">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="apName" type="tAccessPointName" use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tServer">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="Authentication">
                    <xs:complexType>
```

```

                <xs:attributeGroup ref="agAuthentication"/>
            </xs:complexType>
        </xs:element>
        <xs:element name="LDevice" type="tLDevice" maxOccurs="unbounded">
            <xs:unique name="uniqueLNInLDevice">
                <xs:selector xpath=".//scl:LN"/>
                <xs:field xpath="@inst"/>
                <xs:field xpath="@lnClass"/>
                <xs:field xpath="@prefix"/>
            </xs:unique>
        </xs:element>
        <xs:element name="Association" type="tAssociation" minOccurs="0"
maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="timeout" type="xs:unsignedInt" use="optional" default="30"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tLDevice">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element ref="LN0"/>
                <xs:element ref="LN" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="AccessControl" type="tAccessControl" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="inst" type="tLDInst" use="required"/>
            <xs:attribute name="ldName" type="tLDName" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tAccessControl" mixed="true">
    <xs:complexContent>
        <xs:extension base="tAnyContentFromOtherNamespace"/>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tAssociation">
    <xs:attributeGroup ref="agLNRef"/>
    <xs:attribute name="kind" type="tAssociationKindEnum" use="required"/>
    <xs:attribute name="associationID" type="tAssociationID" use="optional"/>

```

```
</xs:complexType>
<xs:element name="LN0">
    <xs:complexType>
        <xs:complexContent>
            <xs:extension base="tLN0"/>
        </xs:complexContent>
    </xs:complexType>
    <xs:unique name="uniqueReportControlInLN0">
        <xs:selector xpath=".//scl:ReportControl"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueLogControlInLN0">
        <xs:selector xpath=".//scl:LogControl"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueGSEControlInLN0">
        <xs:selector xpath=".//scl:GSEControl"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueSampledValueControlInLN0">
        <xs:selector xpath=".//scl:SampledValueControl"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:key name="DataSetKeyLN0">
        <xs:selector xpath=".//scl:DataSet"/>
        <xs:field xpath="@name"/>
    </xs:key>
    <xs:keyref name="ref2DataSetReportLN0" refer="DataSetKeyLN0">
        <xs:selector xpath=".//scl:ReportControl"/>
        <xs:field xpath="@datSet"/>
    </xs:keyref>
    <xs:keyref name="ref2DataSetLogLN0" refer="DataSetKeyLN0">
        <xs:selector xpath=".//scl:LogControl"/>
        <xs:field xpath="@datSet"/>
    </xs:keyref>
    <xs:keyref name="ref2DataSetGSELN0" refer="DataSetKeyLN0">
        <xs:selector xpath=".//scl:GSEControl"/>
        <xs:field xpath="@datSet"/>
    </xs:keyref>
```

```
<xs:keyref name="ref2DataSetSVLN0" refer="DataSetKeyLN0">
    <xs:selector xpath=".//scl:SampledValueControl"/>
    <xs:field xpath="@datSet"/>
</xs:keyref>
<xs:unique name="uniqueDOIinLN0">
    <xs:selector xpath=".//scl:DOI"/>
    <xs:field xpath="@name"/>
</xs:unique>
<xs:unique name="uniqueLogInLN0">
    <xs:selector xpath=".//scl:Log"/>
    <xs:field xpath="@name"/>
</xs:unique>
</xs:element>
<xs:element name="LN" type="tLN">
    <xs:unique name="uniqueReportControlInLN">
        <xs:selector xpath=".//scl:ReportControl"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueLogControlInLN">
        <xs:selector xpath=".//scl:LogControl"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:key name="DataSetKeyInLN">
        <xs:selector xpath=".//scl:DataSet"/>
        <xs:field xpath="@name"/>
    </xs:key>
    <xs:keyref name="ref2DataSetReport" refer="DataSetKeyInLN">
        <xs:selector xpath=".//scl:ReportControl"/>
        <xs:field xpath="@datSet"/>
    </xs:keyref>
    <xs:keyref name="ref2DataSetLog" refer="DataSetKeyInLN">
        <xs:selector xpath=".//scl:LogControl"/>
        <xs:field xpath="@datSet"/>
    </xs:keyref>
    <xs:unique name="uniqueDOIinLN">
        <xs:selector xpath=".//scl:DOI"/>
        <xs:field xpath="@name"/>
    </xs:unique>
    <xs:unique name="uniqueLogInLN">
        <xs:selector xpath=".//scl:Log"/>
```

```

        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
<xs:complexType name="tAnyLN" abstract="true">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="DataSet" type="tDataSet" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="ReportControl" type="tReportControl" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="LogControl" type="tLogControl" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="DOI" type="tDOI" minOccurs="0" maxOccurs="unbounded">
                    <xs:unique name="uniqueSDI_DAIinDOI">
                        <xs:selector xpath=".//scl:DAI|.//scl:SDI"/>
                        <xs:field xpath="@name"/>
                        <xs:field xpath="@ix"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="Inputs" type="tInputs" minOccurs="0">
                    <!--<xs:unique name="uniqueExtRefInInputs">
                    <xs:selector xpath=".//scl:ExtRef"/>
                    <xs:field xpath="@iedName"/>
                    <xs:field xpath="@ldInst"/>
                    <xs:field xpath="@prefix"/>
                    <xs:field xpath="@lnClass"/>
                    <xs:field xpath="@lnInst"/>
                    <xs:field xpath="@doName"/>
                    <xs:field xpath="@daName"/>
                    <xs:field xpath="@intAddr"/>
                    </xs:unique>-->
                    </xs:element>
                    <xs:element name="Log" type="scl:tLog" minOccurs="0" maxOccurs="unbounded"/>
                </xs:sequence>
                <xs:attribute name="lnType" type="tName" use="required"/>
            </xs:extension>
        </xs:complexContent>
    </xs:complexType>
<xs:complexType name="tLN">
    <xs:complexContent>

```

```

<xs:extension base="tAnyLN">
    <xs:attribute name="prefix" type="tPrefix" use="optional" default="" />
    <xs:attribute name="lnClass" type="tLNClassEnum" use="required" />
    <xs:attribute name="inst" type="tLNInst" use="required" />
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tLN0">
    <xs:complexContent>
        <xs:extension base="tAnyLN">
            <xs:sequence>
                <xs:element name="GSEControl" type="tGSEControl" minOccurs="0" maxOccurs="unbounded" />
                <xs:element name="SampledValueControl" type="tSampledValueControl" minOccurs="0" maxOccurs="unbounded" />
                <xs:element name="SettingControl" type="tSettingControl" minOccurs="0" />
            </xs:sequence>
            <xs:attribute name="lnClass" type="tLNClassEnum" use="required" fixed="LLN0" />
            <xs:attribute name="inst" type="xs:normalizedString" use="required" fixed="" />
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tDataSet">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:choice maxOccurs="unbounded">
                <xs:element name="FCDA" type="tFCDA" />
            </xs:choice>
            <xs:attribute name="name" type="tDataSetName" use="required" />
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tFCDA">
    <xs:attribute name="ldInst" type="tLDInst" use="optional" />
    <xs:attribute name="prefix" type="tPrefix" use="optional" default="" />
    <xs:attribute name="lnClass" type="tLNClassEnum" use="optional" />
    <xs:attribute name="lnInst" type="tLNInst" use="optional" />
    <xs:attribute name="doName" type="tFullDOName" use="optional" />
    <xs:attribute name="daName" type="tFullAttributeName" use="optional" />
    <xs:attribute name="fc" type="tFCEnum" use="required" />
    <xs:attribute name="ix" type="xs:unsignedInt" use="optional" />

```

```
</xs:complexType>
<xs:complexType name="tControl" abstract="true">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="name" type="tCBName" use="required"/>
            <xs:attribute name="datSet" type="tDataSetName" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tControlWithTriggerOpt" abstract="true">
    <xs:complexContent>
        <xs:extension base="tControl">
            <xs:sequence>
                <xs:element name="TrgOps" type="tTrgOps" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="intgPd" type="xs:unsignedInt" use="optional" default="0"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tTrgOps">
    <xs:attribute name="dchg" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="qchg" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="upd" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="period" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="gi" type="xs:boolean" use="optional" default="true"/>
</xs:complexType>
<xs:complexType name="tReportControl">
    <xs:complexContent>
        <xs:extension base="tControlWithTriggerOpt">
            <xs:sequence>
                <xs:element name="OptFields">
                    <xs:complexType>
                        <xs:attributeGroup ref="agOptFields"/>
                    </xs:complexType>
                </xs:element>
                <xs:element name="RptEnabled" type="tRptEnabled" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="rptID" type="tMessageID" use="optional"/>
            <xs:attribute name="confRev" type="xs:unsignedInt" use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
```

```

        <xs:attribute name="buffered" type="xs:boolean" use="optional" default="false"/>
        <xs:attribute name="bufTime" type="xs:unsignedInt" use="optional" default="0"/>
        <xs:attribute name="indexed" type="xs:boolean" use="optional" default="true"/>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tRptEnabled">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="ClientLN" type="tClientLN" minOccurs="0" maxOccurs="unbounded"/>
            </xs:sequence>
            <xs:attribute name="max" use="optional" default="1">
                <xs:simpleType>
                    <xs:restriction base="xs:unsignedInt">
                        <xs:minExclusive value="0"/>
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tClientLN">
    <xs:attributeGroup ref="agLNRef"/>
    <xs:attribute name="apRef" type="tAccessPointName" use="optional"/>
</xs:complexType>
<xs:complexType name="tLogControl">
    <xs:complexContent>
        <xs:extension base="tControlWithTriggerOpt">
            <xs:attribute name="ldInst" type="tLDInst" use="optional"/>
            <xs:attribute name="prefix" type="tPrefix" use="optional" default="" />
            <xs:attribute name="lnClass" type="tLNClassEnum" use="optional" default="LLN0"/>
            <xs:attribute name="lnInst" type="tLNInst" use="optional"/>
            <xs:attribute name="logName" type="tLogName" use="required"/>
            <xs:attribute name="logEna" type="xs:boolean" use="optional" default="true"/>
            <xs:attribute name="reasonCode" type="xs:boolean" use="optional" default="true"/>
            <xs:attribute name="bufTime" type="xs:unsignedInt" use="optional" default="0"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

```

```
<xs:complexType name="tInputs">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="ExtRef" type="tExtRef" maxOccurs="unbounded"/>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tExtRef">
    <xs:attributeGroup ref="scl:agDesc"/>
    <xs:attribute name="iedName" type="tIEDNameOrRelative" use="optional"/>
    <xs:attribute name="ldInst" type="tLDInst" use="optional"/>
    <xs:attribute name="prefix" type="tPrefix" use="optional"/>
    <xs:attribute name="lnClass" type="tLNClassEnum" use="optional"/>
    <xs:attribute name="lnInst" type="tLNInst" use="optional"/>
    <xs:attribute name="doName" type="tFullDOName" use="optional"/>
    <xs:attribute name="daName" type="tFullAttributeName" use="optional"/>
    <xs:attribute name="intAddr" type="xs:normalizedString" use="optional"/>
    <xs:attribute name="serviceType" type="tServiceType" use="optional"/>
    <xs:attribute name="srcLDInst" type="tLDInst" use="optional"/>
    <xs:attribute name="srcPrefix" type="tPrefix" use="optional"/>
    <xs:attribute name="srcLNClass" type="tLNClassEnum" use="optional"/>
    <xs:attribute name="srcLNInst" type="tLNInst" use="optional"/>
    <xs:attribute name="srcCBName" type="tCBName" use="optional"/>
    <xs:attribute name="pServT" type="tServiceType" use="optional"/>
    <xs:attribute name="pLN" type="tLNClassEnum" use="optional"/>
    <xs:attribute name="pDO" type="tFullDOName" use="optional"/>
    <xs:attribute name="pDA" type="tFullAttributeName" use="optional"/>
</xs:complexType>
<xs:complexType name="tLog">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="name" type="tLogName" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tControlWithIEDName">
    <xs:complexContent>
```

```

<xs:extension base="tControl">
    <xs:sequence>
        <xs:element name="IEDName" minOccurs="0" maxOccurs="unbounded">
            <xs:complexType>
                <xs:simpleContent>
                    <xs:extension base="tIEDName">
                        <xs:attribute name="apRef" type="tAccessPointName"
use="optional"/>
                        <xs:attribute name="ldInst" type="tLDInst" use="optional"/>
                        <xs:attribute name="prefix" type="tPrefix" use="optional"/>
                        <xs:attribute name="lnClass" type="tLNClassEnum"
use="optional"/>
                        <xs:attribute name="lnInst" type="tLNInst" use="optional"/>
                    </xs:extension>
                </xs:simpleContent>
            </xs:complexType>
        </xs:element>
    </xs:sequence>
    <xs:attribute name="confRev" type="xs:unsignedInt" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tProtocol">
    <xs:simpleContent>
        <xs:extension base="xs:normalizedString">
            <xs:attribute name="mustUnderstand" type="xs:boolean" use="required" fixed="true"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tGSEControl">
    <xs:complexContent>
        <xs:extension base="tControlWithIEDName">
            <xs:sequence>
                <xs:element name="Protocol" type="tProtocol" fixed="R-GOOSE" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="type" type="tGSEControlTypeEnum" use="optional" default="GOOSE"/>
            <xs:attribute name="appID" type="tMessageID" use="required"/>
            <xs:attribute name="fixedOffs" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="securityEnable" type="scl:tPredefinedTypeOfSecurityEnum" use="optional"
default="None"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

```

```
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tSampledValueControl">
    <xs:complexContent>
        <xs:extension base="tControlWithIEDName">
            <xs:sequence>
                <xs:element name="SmvOpts">
                    <xs:complexType>
                        <xs:attributeGroup ref="agSmvOpts"/>
                    </xs:complexType>
                </xs:element>
                <xs:element name="Protocol" type="tProtocol" fixed="R-SV" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="smvID" type="tMessageID" use="required"/>
            <xs:attribute name="multicast" type="xs:boolean" default="true"/>
            <xs:attribute name="smpRate" type="xs:unsignedInt" use="required"/>
            <xs:attribute name="nofASDU" type="xs:unsignedInt" use="required"/>
            <xs:attribute name="smpMod" type="tSmpMod" use="optional" default="SmpPerPeriod"/>
            <xs:attribute name="securityEnable" type="tPredefinedTypeOfSecurityEnum" use="optional"
                           default="None"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSettingControl">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:attribute name="numOfSGs" use="required">
                <xs:simpleType>
                    <xs:restriction base="xs:unsignedInt">
                        <xs:minInclusive value="1"/>
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
            <xs:attribute name="actSG" use="optional" default="1">
                <xs:simpleType>
                    <xs:restriction base="xs:unsignedInt">
                        <xs:minInclusive value="1"/>
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
```

```

        </xs:simpleType>
    </xs:attribute>
    <xs:attribute name="resvTms" type="xs:unsignedShort" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tDOI">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:choice minOccurs="0" maxOccurs="unbounded">
                <xs:element name="SDI" type="tSDI">
                    <xs:unique name="uniqueSDI_DAIinSDI">
                        <xs:selector xpath=".//scl:DAI|./scl:SDI"/>
                        <xs:field xpath="@name"/>
                        <xs:field xpath="@ix"/>
                    </xs:unique>
                </xs:element>
                <xs:element name="DAI" type="tDAI"/>
            </xs:choice>
            <xs:attribute name="name" type="tDataName" use="required"/>
            <xs:attribute name="ix" type="xs:unsignedInt" use="optional"/>
            <xs:attribute name="accessControl" type="xs:normalizedString" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSDI">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:choice minOccurs="0" maxOccurs="unbounded">
                <xs:element name="SDI" type="tSDI"/>
                <xs:element name="DAI" type="tDAI"/>
            </xs:choice>
            <xs:attribute name="name" type="tAttributeNameEnum" use="required"/>
            <xs:attribute name="ix" type="xs:unsignedInt" use="optional"/>
            <xs:attribute name="sAddr" type="xs:normalizedString" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tDAI">
    <xs:complexContent>

```

```
<xs:extension base="tUnNaming">
    <xs:sequence>
        <xs:element name="Val" type="tVal" minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
    <xs:attribute name="name" type="tAttributeNameEnum" use="required"/>
    <xs:attribute name="sAddr" type="xs:normalizedString" use="optional"/>
    <xs:attribute name="valKind" type="tValKindEnum" use="optional"/>
    <xs:attribute name="ix" type="xs:unsignedInt" use="optional"/>
    <xs:attribute name="valImport" type="xs:boolean" use="optional"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tServiceYesNo"/>
<xs:complexType name="tServiceWithOptionalMax">
    <xs:attribute name="max" type="xs:unsignedInt" use="optional"/>
</xs:complexType>
<xs:complexType name="tServiceWithMax">
    <xs:attribute name="max" type="xs:unsignedInt" use="required"/>
</xs:complexType>
<xs:complexType name="tServiceWithMaxNonZero">
    <xs:attribute name="max" use="required">
        <xs:simpleType>
            <xs:restriction base="xs:unsignedInt">
                <xs:minExclusive value="0"/>
            </xs:restriction>
        </xs:simpleType>
    </xs:attribute>
</xs:complexType>
<xs:complexType name="tServiceConfReportControl">
    <xs:complexContent>
        <xs:extension base="tServiceWithMax">
            <xs:attribute name="bufMode" use="optional" default="both">
                <xs:simpleType>
                    <xs:restriction base="xs:Name">
                        <xs:enumeration value="unbuffered"/>
                        <xs:enumeration value="buffered"/>
                        <xs:enumeration value="both"/>
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
```

```

        </xs:attribute>
        <xs:attribute name="bufConf" type="xs:boolean" use="optional" default="false"/>
        <xs:attribute name="maxBuf" type="xs:unsignedInt" use="optional"/>
    </xs:extension>
</xs:complexContent>
<xs:complexType name="tServiceWithMaxAndMaxAttributes">
    <xs:complexContent>
        <xs:extension base="tServiceWithMax">
            <xs:attribute name="maxAttributes" use="optional">
                <xs:simpleType>
                    <xs:restriction base="xs:unsignedInt">
                        <xs:minExclusive value="0"/>
                    </xs:restriction>
                </xs:simpleType>
            </xs:attribute>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tServiceWithMaxAndModify">
    <xs:complexContent>
        <xs:extension base="tServiceWithMax">
            <xs:attribute name="modify" type="xs:boolean" use="optional" default="true"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tServiceForConfDataSet">
    <xs:complexContent>
        <xs:extension base="tServiceWithMaxAndMaxAttributes">
            <xs:attribute name="modify" type="xs:boolean" use="optional" default="true"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tClientServices">
    <xs:sequence>
        <xs:element name="TimeSyncProt" type="scl:tTimeSyncProt" minOccurs="0"/>
        <xs:element name="McSecurity" type="scl:tMcSecurity" minOccurs="0"/>
    </xs:sequence>
    <xs:attribute name="goose" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="gsse" type="xs:boolean" use="optional" default="false"/>

```

```
<xs:attribute name="bufReport" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="unbufReport" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="readLog" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="sv" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="supportsLdName" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="maxAttributes" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedInt"/>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="maxReports" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedInt"/>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="maxGOOSE" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedInt"/>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="maxSMV" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedInt"/>
    </xs:simpleType>
</xs:attribute>
<xs:attribute name="rGOOSE" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="rSV" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="noIctBinding" type="xs:boolean" use="optional" default="false"/>
</xs:complexType>
<xs:complexType name="tServiceSettings" abstract="true">
    <xs:attribute name="cbName" type="tServiceSettingsNoDynEnum" use="optional" default="Fix"/>
    <xs:attribute name="datSet" type="tServiceSettingsEnum" use="optional" default="Fix"/>
</xs:complexType>
<xs:complexType name="tReportSettings">
    <xs:complexContent>
        <xs:extension base="tServiceSettings">
            <xs:attribute name="rptID" type="tServiceSettingsEnum" use="optional" default="Fix"/>
            <xs:attribute name="optFields" type="tServiceSettingsEnum" use="optional" default="Fix"/>
            <xs:attribute name="bufTime" type="tServiceSettingsEnum" use="optional" default="Fix"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
```

```

        <xs:attribute name="trgOps" type="tServiceSettingsEnum" use="optional" default="Fix"/>
        <xs:attribute name="intgPd" type="tServiceSettingsEnum" use="optional" default="Fix"/>
        <xs:attribute name="resvTms" type="xs:boolean" use="optional" default="false"/>
        <xs:attribute name="owner" type="xs:boolean" use="optional" default="false"/>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tLogSettings">
    <xs:complexContent>
        <xs:extension base="tServiceSettings">
            <xs:attribute name="logEna" type="tServiceSettingsEnum" use="optional" default="Fix"/>
            <xs:attribute name="trgOps" type="tServiceSettingsEnum" use="optional" default="Fix"/>
            <xs:attribute name="intgPd" type="tServiceSettingsEnum" use="optional" default="Fix"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tGSESettings">
    <xs:complexContent>
        <xs:extension base="tServiceSettings">
            <xs:sequence>
                <xs:element name="McSecurity" type="scl:tMcSecurity" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="appID" type="tServiceSettingsEnum" use="optional" default="Fix"/>
            <xs:attribute name="dataLabel" type="tServiceSettingsEnum" use="optional" default="Fix"/>
            <xs:attribute name="kdaParticipant" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSMVSettings">
    <xs:complexContent>
        <xs:extension base="tServiceSettings">
            <xs:sequence>
                <xs:choice maxOccurs="unbounded">
                    <xs:element name="SmpRate">
                        <xs:simpleType>
                            <xs:restriction base="xs:unsignedInt">
                                <xs:minExclusive value="0"/>
                            </xs:restriction>
                        </xs:simpleType>
                    </xs:element>
                </xs:choice>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

```

```

<xs:element name="SamplesPerSec">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedInt">
            <xs:minExclusive value="0"/>
        </xs:restriction>
    </xs:simpleType>
</xs:element>
<xs:element name="SecPerSamples">
    <xs:simpleType>
        <xs:restriction base="xs:unsignedInt">
            <xs:minExclusive value="0"/>
        </xs:restriction>
    </xs:simpleType>
</xs:element>
</xs:choice>
<xs:element name="McSecurity" type="scl:tMcSecurity" minOccurs="0"/>
</xs:sequence>
<xs:attribute name="svID" type="tServiceSettingsEnum" use="optional" default="Fix"/>
<xs:attribute name="optFields" type="tServiceSettingsEnum" use="optional" default="Fix"/>
<xs:attribute name="smpRate" type="tServiceSettingsEnum" use="optional" default="Fix"/>
<xs:attribute name="samplesPerSec" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="pdcTimeStamp" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="synchSrcId" type="xs:boolean" use="optional" default="false"/>
<xs:attribute name="nofASDU" type="tServiceSettingsNoDynEnum" use="optional" default="Fix"/>
<xs:attribute name="kdaParticipant" type="xs:boolean" use="optional" default="false"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tConfLNs">
    <xs:attribute name="fixPrefix" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="fixLnInst" type="xs:boolean" use="optional" default="false"/>
</xs:complexType>
<xs:complexType name="tValueHandling">
    <xs:attribute name="setToRO" type="xs:boolean" use="optional" default="false"/>
</xs:complexType>
<xs:complexType name="tFileHandling">
    <xs:complexContent>
        <xs:extension base="tServiceYesNo">
            <xs:attribute name="mms" type="xs:boolean" use="optional" default="true"/>

```

```

        <xs:attribute name="ftp" type="xs:boolean" use="optional" default="false"/>
        <xs:attribute name="ftps" type="xs:boolean" use="optional" default="false"/>
    </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tGOOSEcapabilities">
    <xs:complexContent>
        <xs:extension base="tServiceWithMax">
            <xs:attribute name="fixedOffs" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="goose" type="xs:boolean" use="optional" default="true"/>
            <xs:attribute name="rGOOSE" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tRedProt">
    <xs:attribute name="hsr" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="prp" type="xs:boolean" use="optional" default="false"/>
    <xs:attribute name="rstp" type="xs:boolean" use="optional" default="false"/>
</xs:complexType>
<xs:complexType name="tTimeSyncProt">
    <xs:complexContent>
        <xs:extension base="tServiceYesNo">
            <xs:attribute name="snmp" type="xs:boolean" use="optional" default="true"/>
            <xs:attribute name="iec61850_9_3" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="c37_238" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="other" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSMVsc">
    <xs:complexContent>
        <xs:extension base="tServiceWithMax">
            <xs:attribute name="delivery" type="tSMVDeliveryEnum" use="optional" default="multicast"/>
            <xs:attribute name="deliveryConf" type="xs:boolean" use="optional" default="false"/>
            <xs:attribute name="sv" type="xs:boolean" use="optional" default="true"/>
            <xs:attribute name="rSV" type="xs:boolean" use="optional" default="false"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSupSubscription">

```

```
<xs:attribute name="maxGo" type="xs:unsignedInt" use="required"/>
<xs:attribute name="maxSv" type="xs:unsignedInt" use="required"/gt;
</xs:complexType>
<xs:complexType name="tCommProt">
    <xs:complexContent>
        <xs:extension base="tServiceYesNo">
            <xs:attribute name="ipv6" type="xs:boolean" use="optional" default="false"/gt;
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tMcSecurity">
    <xs:attribute name="signature" type="xs:boolean" use="optional" default="false"/gt;
    <xs:attribute name="encryption" type="xs:boolean" use="optional" default="false"/gt;
</xs:complexType>
<xs:complexType name="tKDC">
    <xs:attribute name="iedName" type="tIEDName" use="required"/gt;
    <xs:attribute name="apName" type="tAccessPointName" use="required"/gt;
</xs:complexType>
<xs:complexType name="tSettingGroups">
    <xs:all>
        <xs:element name="SGEdit" minOccurs="0">
            <xs:complexType>
                <xs:complexContent>
                    <xs:extension base="tServiceYesNo">
                        <xs:attribute name="resvTms" type="xs:boolean" use="optional"
default="false"/gt;
                    </xs:extension>
                </xs:complexContent>
            </xs:complexType>
        </xs:element>
        <xs:element name="ConfSG" minOccurs="0">
            <xs:complexType>
                <xs:complexContent>
                    <xs:extension base="tServiceYesNo">
                        <xs:attribute name="resvTms" type="xs:boolean" use="optional"
default="false"/gt;
                    </xs:extension>
                </xs:complexContent>
            </xs:complexType>
        </xs:element>
    </xs:all>
</xs:complexType>
```

```

        </xs:element>
    </xs:all>
</xs:complexType>
<xs:element name="IED" type="tIED">
    <xs:key name="LDeviceInIEDKey">
        <xs:selector xpath=".//scl:AccessPoint/scl:Server/scl:LDevice"/>
        <xs:field xpath="@inst"/>
    </xs:key>
    <xs:keyref name="ref2LDeviceInDataSetForFCDAinLN" refer="LDeviceInIEDKey">
        <xs:selector xpath=".//scl:AccessPoint/scl:Server/scl:LDevice/scl:LN/scl:DataSet/scl:FCDA"/>
        <xs:field xpath="@ldInst"/>
    </xs:keyref>
    <xs:keyref name="ref2LDeviceInDataSetForFCDAinLN0" refer="LDeviceInIEDKey">
        <xs:selector xpath=".//scl:AccessPoint/scl:Server/scl:LDevice/scl:LN0/scl:DataSet/scl:FCDA"/>
        <xs:field xpath="@ldInst"/>
    </xs:keyref>
    <xs:key name="AccessPointInIEDKey">
        <xs:selector xpath=".//scl:AccessPoint"/>
        <xs:field xpath="@name"/>
    </xs:key>
    <xs:keyref name="ServerAtRef2AccessPoint" refer="AccessPointInIEDKey">
        <xs:selector xpath=".//scl:AccessPoint/scl:ServerAt"/>
        <xs:field xpath="@apName"/>
    </xs:keyref>
</xs:element>
</xs:schema>

```

#### e) Communication subnetworks (SCL\_Communication.xsd)

- File SCL\_Communication.xsd :

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:scl="http://www.iec.ch/61850/2003/SCL"
    xmlns="http://www.iec.ch/61850/2003/SCL" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2007B4">
    <xs:annotation>
        <xs:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.
            COPYRIGHT (c) IEC, 2016. All rights reserved. Disclaimer: The IEC disclaims liability for any
            personal injury,

```

property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from this software and the document upon which its methods are based, use of, or reliance upon.

```
</xs:documentation>
</xs:annotation>
<xs:include schemaLocation="SCL_BaseTypes.xsd"/>
<xs:complexType name="tControlBlock" abstract="true">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="Address" type="tAddress" minOccurs="0"/>
            </xs:sequence>
            <xs:attribute name="ldInst" type="tLDInst" use="required"/>
            <xs:attribute name="cbName" type="tCBName" use="required"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tCommunication">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="SubNetwork" type="tSubNetwork" maxOccurs="unbounded">
                    <xs:unique name="uniqueConnectedAP">
                        <xs:selector xpath=".//scl:ConnectedAP"/>
                        <xs:field xpath="@iedName"/>
                        <xs:field xpath="@apName"/>
                    </xs:unique>
                </xs:element>
            </xs:sequence>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>
<xs:complexType name="tSubNetwork">
    <xs:complexContent>
        <xs:extension base="tNaming">
            <xs:sequence>
                <xs:element name="BitRate" type="tBitRateInMbPerSec" minOccurs="0"/>
                <xs:element name="ConnectedAP" type="tConnectedAP" maxOccurs="unbounded">
```

```

        <xs:unique name="uniqueGSEinConnectedAP">
            <xs:selector xpath=".//scl:GSE"/>
            <xs:field xpath="@cbName"/>
            <xs:field xpath="@ldInst"/>
        </xs:unique>
        <xs:unique name="uniqueSMVinConnectedAP">
            <xs:selector xpath=".//scl:SMV"/>
            <xs:field xpath="@cbName"/>
            <xs:field xpath="@ldInst"/>
        </xs:unique>
    </xs:element>
</xs:sequence>
<xs:attribute name="type" use="optional">
    <xs:simpleType>
        <xs:restriction base="xs:normalizedString">
            <xs:minLength value="1"/>
        </xs:restriction>
    </xs:simpleType>
</xs:attribute>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType name="tConnectedAP">
    <xs:complexContent>
        <xs:extension base="tUnNaming">
            <xs:sequence>
                <xs:element name="Address" type="tAddress" minOccurs="0"/>
                <xs:element name="GSE" type="tGSE" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="SMV" type="tSMV" minOccurs="0" maxOccurs="unbounded"/>
                <xs:element name="PhysConn" type="tPhysConn" minOccurs="0" maxOccurs="unbounded">
                    <xs:unique name="uniquePTypeInPhysConn">
                        <xs:selector xpath=".//scl:P"/>
                        <xs:field xpath="@type"/>
                    </xs:unique>
                </xs:element>
            </xs:sequence>
            <xs:attribute name="iedName" type="tIEDName" use="required"/>
            <xs:attribute name="apName" type="tAccessPointName" use="required"/>
            <xs:attribute name="redProt" type="scl:tRedProtEnum" use="optional"/>
        </xs:extension>
    </xs:complexContent>
</xs:complexType>

```

```
        </xs:complexContent>
    </xs:complexType>
    <xs:complexType name="tAddress">
        <xs:sequence>
            <xs:element name="P" type="tP" maxOccurs="unbounded"/>
        </xs:sequence>
    </xs:complexType>
    <xs:complexType name="tGSE">
        <xs:complexContent>
            <xs:extension base="tControlBlock">
                <xs:sequence>
                    <xs:element name="MinTime" type="tDurationInMilliSec" minOccurs="0"/>
                    <xs:element name="MaxTime" type="tDurationInMilliSec" minOccurs="0"/>
                </xs:sequence>
            </xs:extension>
        </xs:complexContent>
    </xs:complexType>
    <xs:complexType name="tSMV">
        <xs:complexContent>
            <xs:extension base="tControlBlock"/>
        </xs:complexContent>
    </xs:complexType>
    <xs:complexType name="tPhysConn">
        <xs:complexContent>
            <xs:extension base="tUnNaming">
                <xs:sequence>
                    <xs:element name="P" type="tP_PhysConn" minOccurs="0" maxOccurs="unbounded"/>
                </xs:sequence>
                <xs:attribute name="type" type="tPhysConnTypeEnum" use="required"/>
            </xs:extension>
        </xs:complexContent>
    </xs:complexType>
    <xs:complexType name="tP_PhysConn">
        <xs:simpleContent>
            <xs:extension base="tPAddr">
                <xs:attribute name="type" type="tPTypePhysConnEnum" use="required"/>
            </xs:extension>
        </xs:simpleContent>
    </xs:complexType>
```

```

<xs:complexType name="tP">
    <xs:simpleContent>
        <xs:extension base="tPAddr">
            <xs:attribute name="type" type="tPTTypeEnum" use="required"/>
        </xs:extension>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPbase" abstract="true">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="([0-9]{1,2}|1[0-9]{2}|2[0-4][0-9]|25[0-5])\.([0-9]{1,2}|1[0-9]{2}|2[0-4][0-9]|25[0-5])\.([0-9]{1,2}|1[0-9]{2}|2[0-4][0-9]|25[0-5])" id="IPv4"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IP">
    <xs:simpleContent>
        <xs:restriction base="tP_IPbase">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IP-SUBNET">
    <xs:simpleContent>
        <xs:restriction base="tP_IPbase">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP-SUBNET"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IP-GATEWAY">
    <xs:simpleContent>
        <xs:restriction base="tP_IPbase">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP-GATEWAY"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6base" abstract="true">
    <xs:simpleContent>

```

```
<xs:restriction base="tP">
    <xs:pattern value="([0-9a-f]{1,4}:){7}[0-9a-f]{1,4}" id="IPv6"/>
</xs:restriction>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6">
    <xs:simpleContent>
        <xs:restriction base="tP_IPv6base">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IPv6"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6-SUBNET">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="/[1-9]/|[1-9][0-9]|/1[0-1][0-9]|/12[0-7]" id="IPv6_Subnet"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IPv6-SUBNET"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6-GATEWAY">
    <xs:simpleContent>
        <xs:restriction base="tP_IPv6base">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IPv6-GATEWAY"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_DNSName">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="\s*"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="DNSName"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6FlowLabel">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="[0-9a-fA-F]{1,5}"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
```

```
        <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IPv6FlowLabel"/>
    </xs:restriction>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tp_OSI-NSAP">
    <xs:simpleContent>
        <xs:restriction base="tp">
            <xs:maxLength value="40"/>
            <xs:pattern value="[0-9A-F]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-NSAP"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tp_OSI-TSEL">
    <xs:simpleContent>
        <xs:restriction base="tp">
            <xs:maxLength value="8"/>
            <xs:pattern value="[0-9A-F]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-TSEL"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tp_OSI-SSEL">
    <xs:simpleContent>
        <xs:restriction base="tp">
            <xs:maxLength value="16"/>
            <xs:pattern value="[0-9A-F]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-SSEL"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tp_OSI-PSEL">
    <xs:simpleContent>
        <xs:restriction base="tp">
            <xs:maxLength value="16"/>
            <xs:pattern value="[0-9A-F]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-PSEL"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
```

```
<xs:complexType name="tP_OSI-AP-Title">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="[0-9&#44;]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-AP-Title"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_OSI-AP-Invoke">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:maxLength value="5"/>
            <xs:pattern value="[0-9]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-AP-Invoke"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_OSI-AE-Qualifier">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:maxLength value="5"/>
            <xs:pattern value="[0-9]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-AE-Qualifier"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_OSI-AE-Invoke">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:maxLength value="5"/>
            <xs:pattern value="[0-9]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="OSI-AE-Invoke"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_MAC-Address">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="([0-9A-F]{2})-([0-9A-F]{2})-([0-9A-F]{2})-([0-9A-F]{2})-([0-9A-F]{2})-([0-9A-F]{2})"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
```

```

F]{2}"/>
    <xs:attribute name="type" type="tPTypeEnum" use="required" fixed="MAC-Address"/>
</xs:restriction>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_APPID">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="[0-9A-F]{4}"/>
            <xs:attribute name="type" type="tPTypeEnum" use="required" fixed="APPID"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_VLAN-PRIORITY">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="0-7"/>
            <xs:attribute name="type" type="tPTypeEnum" use="required" fixed="VLAN-PRIORITY"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_VLAN-ID">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="[0-9A-F]{3}"/>
            <xs:attribute name="type" type="tPTypeEnum" use="required" fixed="VLAN-ID"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_Port" abstract="true">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="0"/>
            <xs:pattern value="[1-9][0-9]{0,3}"/>
            <xs:pattern value="[1-5][0-9]{4,4}"/>
            <xs:pattern value="6[0-4][0-9]{3,3}"/>
            <xs:pattern value="65[0-4][0-9]{2,2}"/>
            <xs:pattern value="655[0-2][0-9]"/>
            <xs:pattern value="6553[0-5]"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>

```

```
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_SNTP-Port">
    <xs:simpleContent>
        <xs:restriction base="tP_Port">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="SNTP-Port"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_MMS-Port">
    <xs:simpleContent>
        <xs:restriction base="tP_Port">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="MMS-Port"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_UDP-Port">
    <xs:simpleContent>
        <xs:restriction base="tP_Port">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP-UDP-PORT"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_TCP-Port">
    <xs:simpleContent>
        <xs:restriction base="tP_Port">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP-TCP-PORT"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6ClassOfTraffic">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:pattern value="[0-9]|[1-9][0-9]|1[0-9]{2}|2[0-4][0-9]|25[0-5]" id="Values0-255"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IPv6ClassOfTraffic"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_C37-118-IP-Port">
```

```

<xs:simpleContent>
    <xs:restriction base="tP">
        <xs:pattern value="102[5-9]|10[3-9][0-9]|1[1-9][0-9]| [2-9][0-9]{3}|[1-5][0-9]{4}|6[0-
4][0-9]{3}|65[0-
        4][0-9]{2}|655[0-2][0-9]|6553[0-5]" id="Values1025-65535"/>
        <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="C37-118-IP-Port"/>
    </xs:restriction>
</xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IPv6-IGMPv3Src">
    <xs:simpleContent>
        <xs:restriction base="tP_IPv6base">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IPv6-IGMPv3Src"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IP-IGMPv3Src">
    <xs:simpleContent>
        <xs:restriction base="tP_IPbase">
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP-IGMPv3Src"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:complexType name="tP_IP-ClassOfTraffic">
    <xs:simpleContent>
        <xs:restriction base="tP">
            <xs:maxLength value="2"/>
            <xs:pattern value="[0-9A-F]+"/>
            <xs:attribute name="type" type="tPTTypeEnum" use="required" fixed="IP-ClassOfTraffic"/>
        </xs:restriction>
    </xs:simpleContent>
</xs:complexType>
<xs:element name="Communication" type="tCommunication">
    <xs:unique name="uniqueSubNetwork">
        <xs:selector xpath=".//scl:SubNetwork"/>
        <xs:field xpath="@name"/>
    </xs:unique>
</xs:element>
</xs:schema>

```

**f) Main SCL (SCL.xsd)**

- File SCL.xsd :

```
<?xml version="1.0" encoding="UTF-8"?>
<xss:schema xmlns:scl="http://www.iec.ch/61850/2003/SCL" xmlns="http://www.iec.ch/61850/2003/SCL"
    xmlns:xs="http://www.w3.org/2001/XMLSchema" targetNamespace="http://www.iec.ch/61850/2003/SCL"
    elementFormDefault="qualified" attributeFormDefault="unqualified" finalDefault="extension"
    version="2007B4">
    <xss:annotation>
        <xss:documentation xml:lang="en">
            SCL schema version "2007" revision "B" release 4, for IEC 61850-6 Ed. 2.1.
            Supersedes "2007B3".
            COPYRIGHT (c) IEC, 2016. All rights reserved. Disclaimer: The IEC disclaims liability for any
            personal injury,
            property or other damages of any nature whatsoever, whether special, indirect, consequential or
            compensatory, directly or
            indirectly resulting from this software and the document upon which its methods are based, use of,
            or reliance upon.
            Implemented Ed. 2 Tissues (since "2007B"): 948, 1050, 1175, 1189, 1208, 1328, 1359, 1365, 1397,
            1434, 1448,
            1450, 1458, 1472.
            Tissues not relevant for the SCL schema (since "2007B"): 706 (Ed.3), 837, 847, 865, 873, 883, 884,
            885, 938, 949,
            961, 1048, 1054, 1059, 1118, 1130, 1131, 1147, 1161, 1168, 1170 (Ed.3), 1173, 1185, 1188, 1195,
            1200, 1204,
            1207, 1221, 1224, 1241 (Ed.3), 1255, 1257 (Ed.3), 1280, 1284, 1327, 1337, 1354, 1395, 1398, 1399,
            1400, 1401,
            1402, 1415, 1416, 1419, 1421, 1431, 1444, 1445, 1446, 1447, 1448, 1451, 1452, 1457, 1461, 1471.
        </xss:documentation>
    </xss:annotation>
    <xss:include schemaLocation="SCL_Substation.xsd"/>
    <xss:include schemaLocation="SCL_IED.xsd"/>
    <xss:include schemaLocation="SCL_Communication.xsd"/>
    <xss:include schemaLocation="SCL_DataTypeTemplates.xsd"/>
    <xss:element name="SCL">
        <xss:complexType>
            <xss:complexContent>
                <xss:extension base="tBaseElement">
```

```

<xs:sequence>
    <xs:element name="Header" type="tHeader">
        <xs:unique name="uniqueHitem">
            <xs:selector xpath=".//scl:History/scl:Hitem"/>
            <xs:field xpath="@version"/>
            <xs:field xpath="@revision"/>
        </xs:unique>
    </xs:element>
    <xs:element ref="Substation" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element ref="Communication" minOccurs="0"/>
    <xs:element ref="IED" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element ref="DataTypeTemplates" minOccurs="0"/>
    <xs:element ref="Line" minOccurs="0" maxOccurs="unbounded"/>
    <xs:element ref="Process" minOccurs="0" maxOccurs="unbounded"/>
</xs:sequence>
<xs:attribute name="version" type="tSclVersion" use="required" fixed="2007"/>
<xs:attribute name="revision" type="tSclRevision" use="required" fixed="B"/>
<xs:attribute name="release" type="tSclRelease" use="required" fixed="4"/>
</xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:key name="SubstationKey">
    <xs:selector xpath=".//scl:Substation|./scl:Process|./scl:Line"/>
    <xs:field xpath="@name"/>
</xs:key>
<xs:key name="IEDKey">
    <xs:selector xpath=".//scl:IED"/>
    <xs:field xpath="@name"/>
</xs:key>
<xs:key name="LNodeTypeKey">
    <xs:selector xpath=".//scl:DataTypeTemplates/scl:LNodeType"/>
    <xs:field xpath="@id"/>
    <xs:field xpath="@lnClass"/>
</xs:key>
<xs:keyref name="ref2LNodeTypeDomain1" refer="LNodeTypeKey">
    <xs:selector xpath=".//scl:IED/scl:AccessPoint/scl:LN"/>
    <xs:field xpath="@lnType"/>
    <xs:field xpath="@lnClass"/>
</xs:keyref>
<xs:keyref name="ref2LNodeTypeDomain2" refer="LNodeTypeKey">

```

```
<xs:selector xpath=".//scl:IED/scl:AccessPoint/scl:Server/scl:LDevice/scl:LN"/>
<xs:field xpath="@lnType"/>
<xs:field xpath="@lnClass"/>
</xs:keyref>
<xs:keyref name="ref2LNodeTypeLLN0" refer="LNodeTypeKey">
    <xs:selector xpath=".//scl:IED/scl:AccessPoint/scl:Server/scl:LDevice/scl:LN0"/>
    <xs:field xpath="@lnType"/>
    <xs:field xpath="@lnClass"/>
</xs:keyref>
<xs:keyref name="refConnectedAP2IED" refer="IEDKey">
    <xs:selector xpath=".//scl:Communication/scl:SubNetwork/scl:ConnectedAP"/>
    <xs:field xpath="@iedName"/>
</xs:keyref>
<xs:keyref name="ref2SubstationFromTerminal" refer="scl:SubstationKey">
    <xs:selector xpath=".//scl:Terminal"/>
    <xs:field xpath="@substationName"/>
</xs:keyref>
<xs:key name="ConnectivityNodeKey">
    <xs:selector xpath=".//scl:ConnectivityNode"/>
    <xs:field xpath="@pathName"/>
</xs:key>
</xs:element>
</xs:schema>
```





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[www.pln-litbang.co.id](http://www.pln-litbang.co.id)



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