

Application of IEC61850 in smart grid visualization, simulation and diagnosis



GRIENT Automation, Informatization and smart application



GRIENT Scope of IEC61850



NIST Smart Grid Framework

GRIENT Smart Grid Investment in China



Source: http://www.chyxx.com/industry/201602/385830.html

GRIENT IEC61850 Core



GRIENT Information Model











Substation Configuration Language

Header	Version, Revision, History
Substation	Substation description including primary equipment and their connections, the automation and control target. It also associates the primary equipment to logical functions
Communication	Defines IED's access points and their subnets
IED	Contains IEC configuration information including information model and information exchange
Data Type Template	Defines format of logical devices, logical nodes and data objects



SCL – Object modeling





SCL files and engineering process





IEC61850 based substations





Legacy IED



IEC61850 IED



Visualization, simulation and analysis





Technical challenges

Configuration parsing

• Typical configuration file for substation can be larger than 100MB

Visualization

• Connectors and terminals become data packets in optical fiber network

Big real-time data

- Data processing
- Data storage and indexing

Days	Bays	Capacity	Note
1	1	88.473GB	256B*80*50*24*60*60=88.473GB
1	30	2.654TB	88.473*30=2.654TB
7	30	18.578TB	88.473*30*7=18.578TB

For sampled value data(>95% substation data), Assume a 9-2LE packet size is 256 Bytes, 80 sampled value per cycle.

Configuration parsing VTD-XML

 Load XML bytes into memory

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- Record element details using Virtual Token Descriptor (VTDs)
- Navigate the XML using VTDs



Configuration parsing

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GRIENT Visualization





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Visualization

R PIT	● P101
Inputs	●数据集
保护1三跳出口[SPCSO1.stVal]	<mark>{SPCSO1.st∀al]</mark>
测控三跳[SPCSO48.stVal]	
测控合闸[SPCSO49.stVal]	● P102
隔刀1闭锁[SPCSO5.stVal]	● 数据集
et dsG00SE1	[OpCls.general]
+ dsG00SE2	[OpOpn.general]
	[EnaOp.stVal]



Real-time big data processing



Technical innovations

Multi-core utilization and kernel optimization for fast data exchange Distributed processing infrastructure based on high speed asynchronous data exchange bus

Efficient data storage and mining engine based on electrical model





GRIENT Application – integrated smart substation simulation and analysis





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Integrated smart substation simulation



GRIENT Application – Portable smart substation testing tools





Smart substation analysis interface



GRIENT Future direction – Big Data based integration platform



- Relay information system
- Condition monitoring
- Packet recording and analysis
- Operation management system

