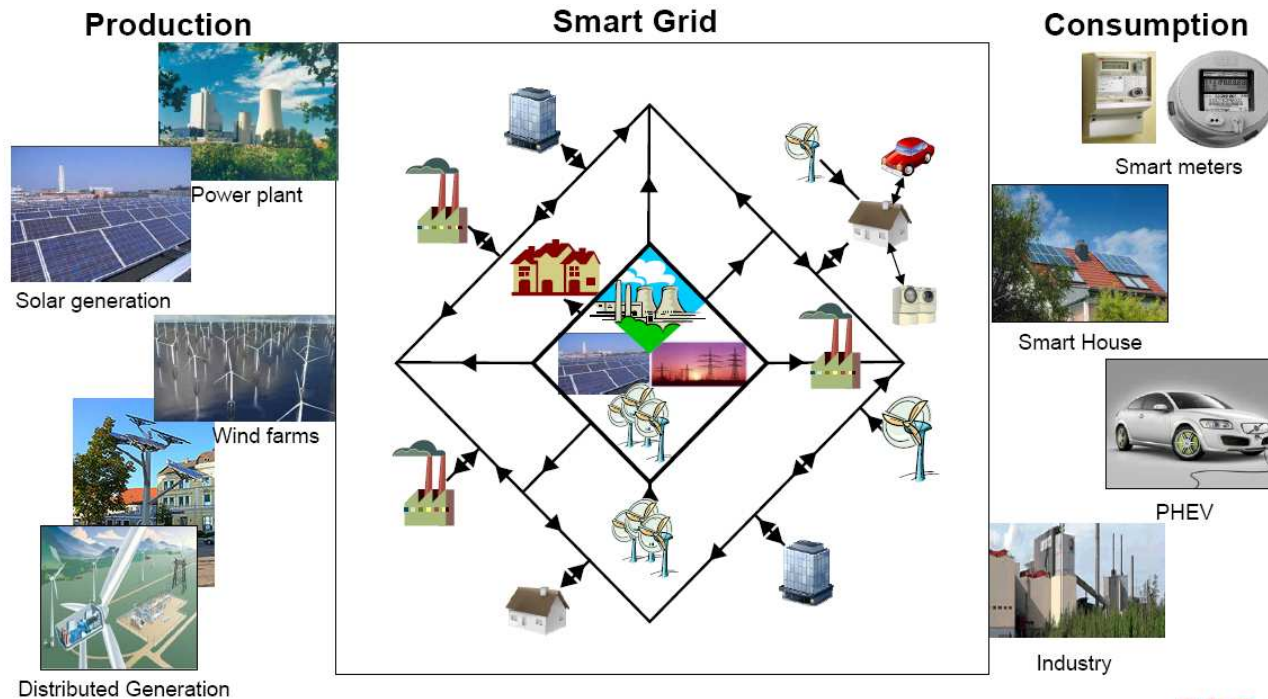




Development of Smart Distribution



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March 28 2011

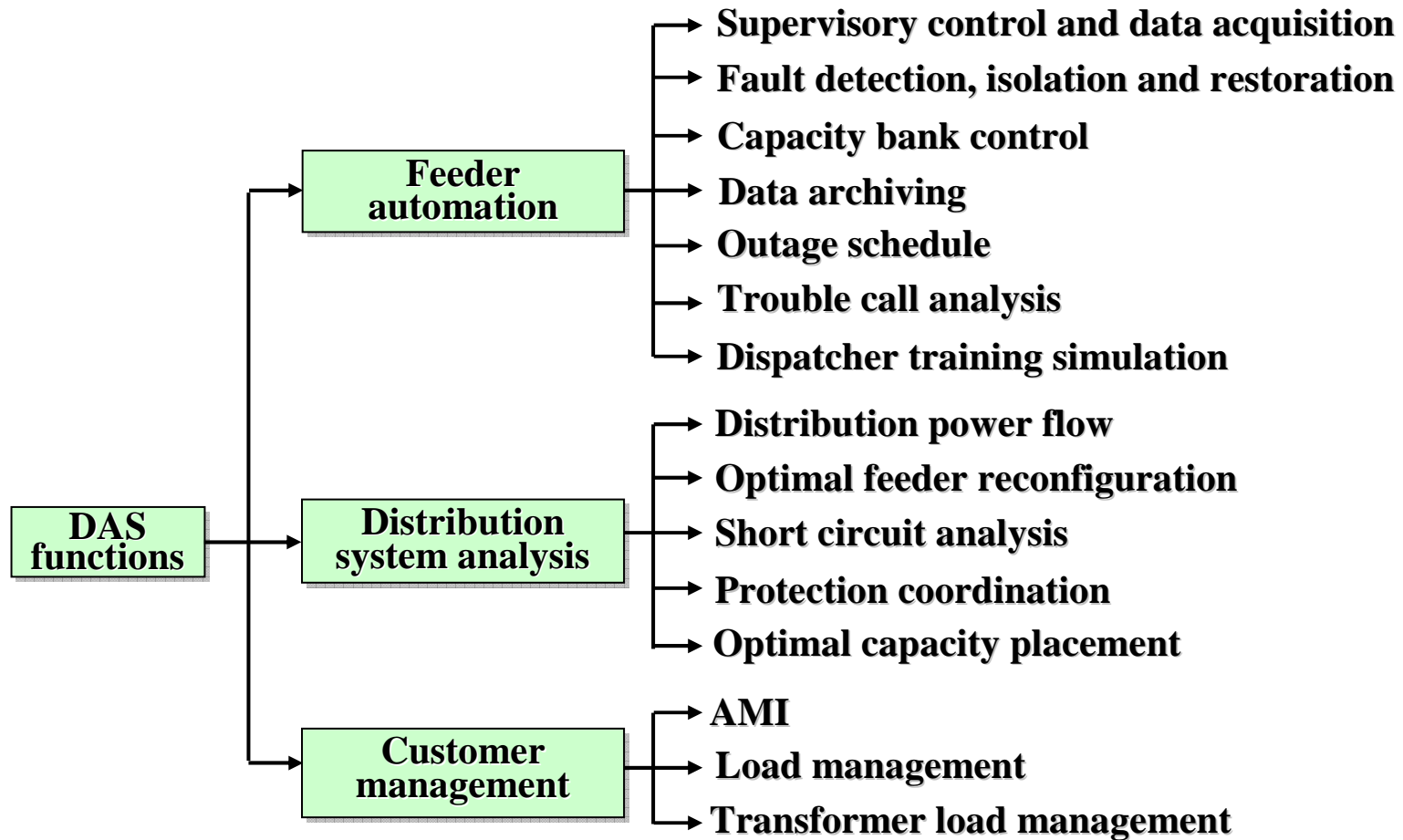


Development of Distribution Automation Systems

- 1. Advancement of ICT Technology**
- 2. Requirement of High Service Reliability**
- 3. Cost/Benefit of DAS Becomes More Justified**



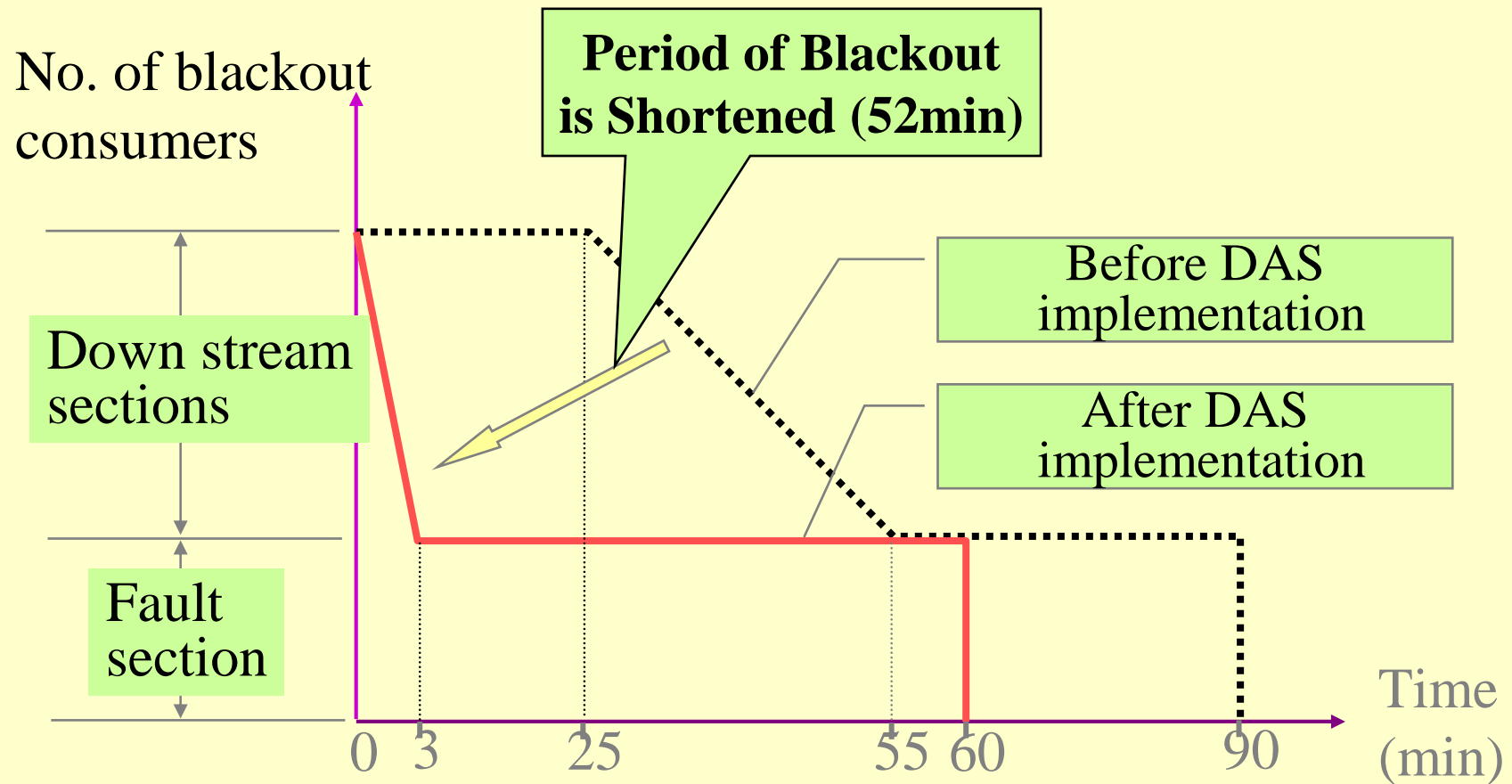
The functions of DAS project in Taipower





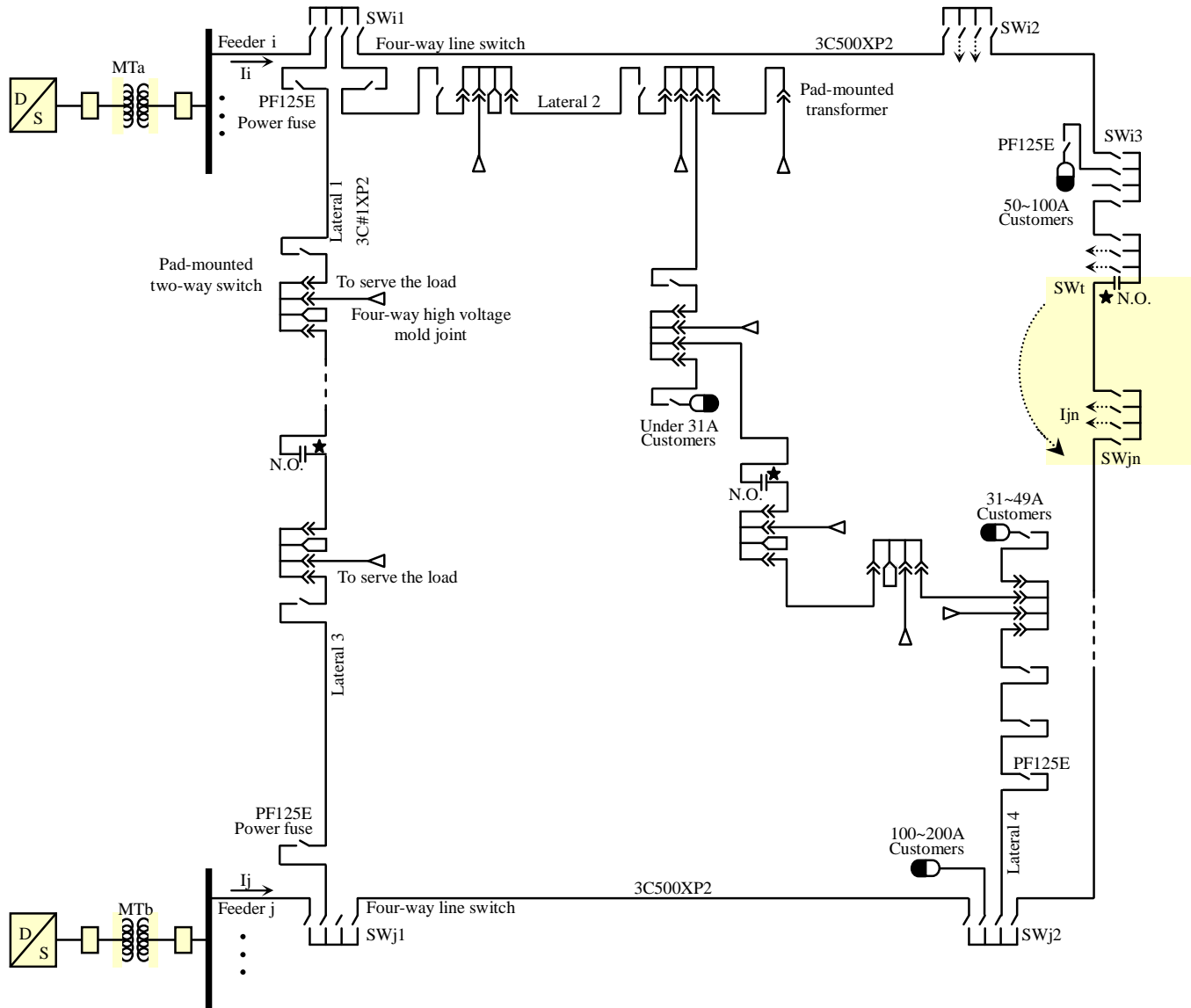
Objective of DAS Systems in Taipower Enhance Service Reliability

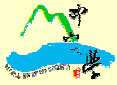
Fault Contingency of Distribution Line



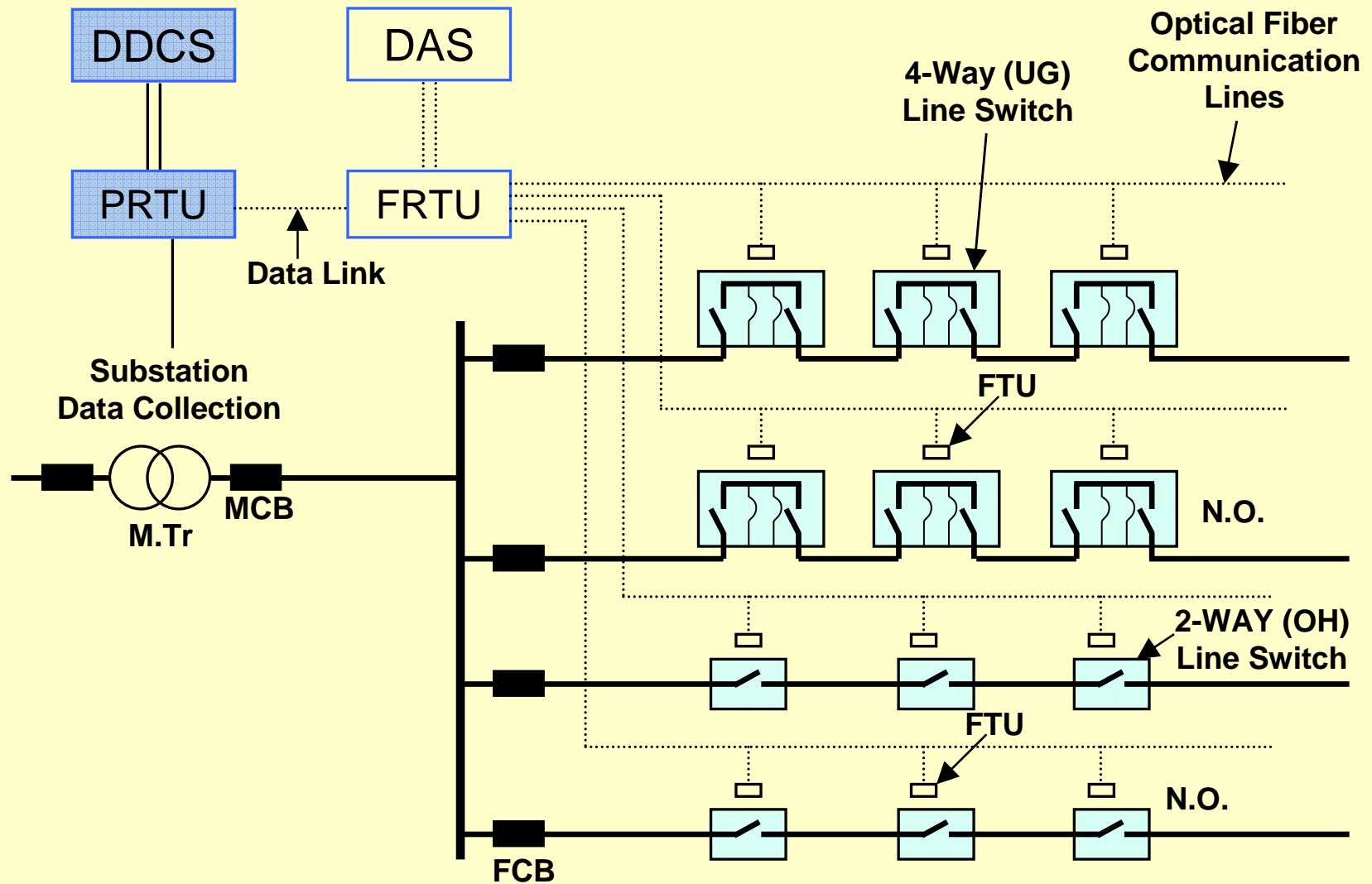


Open Loop Underground Distribution System



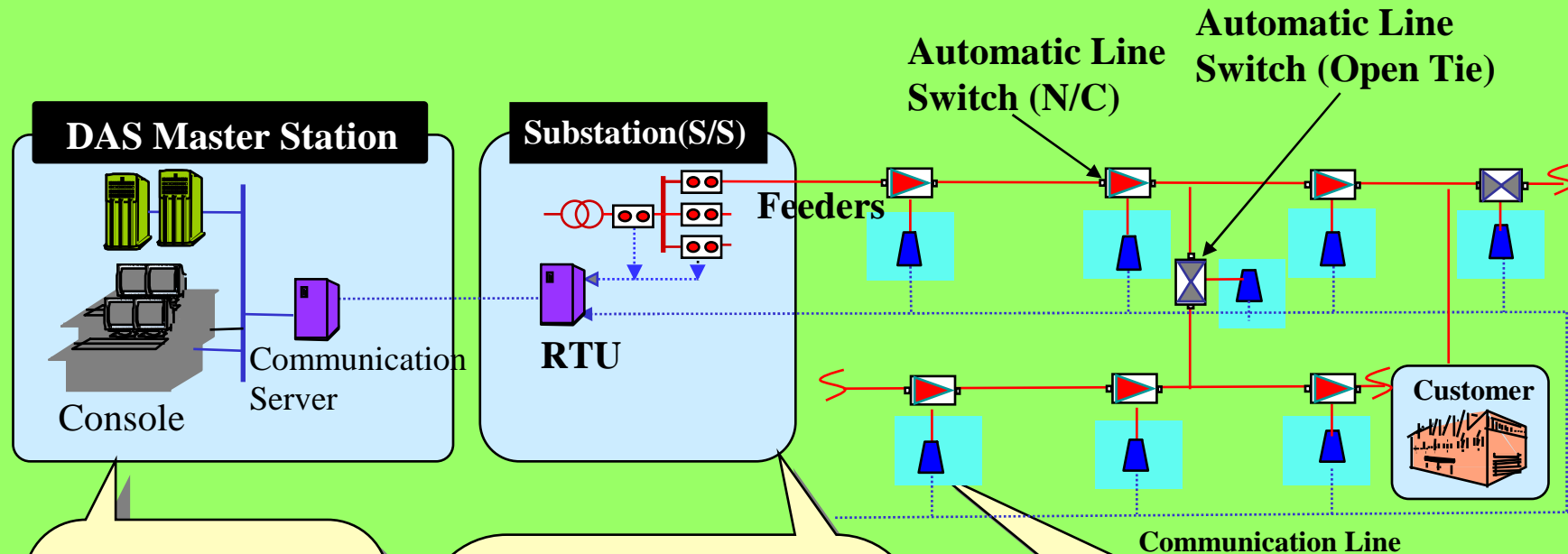


Structure of Open Loop Distribution Automation System





Overall System Configuration (DAS)



- SCADA
- TP
- FDIR
- Data Maintenance

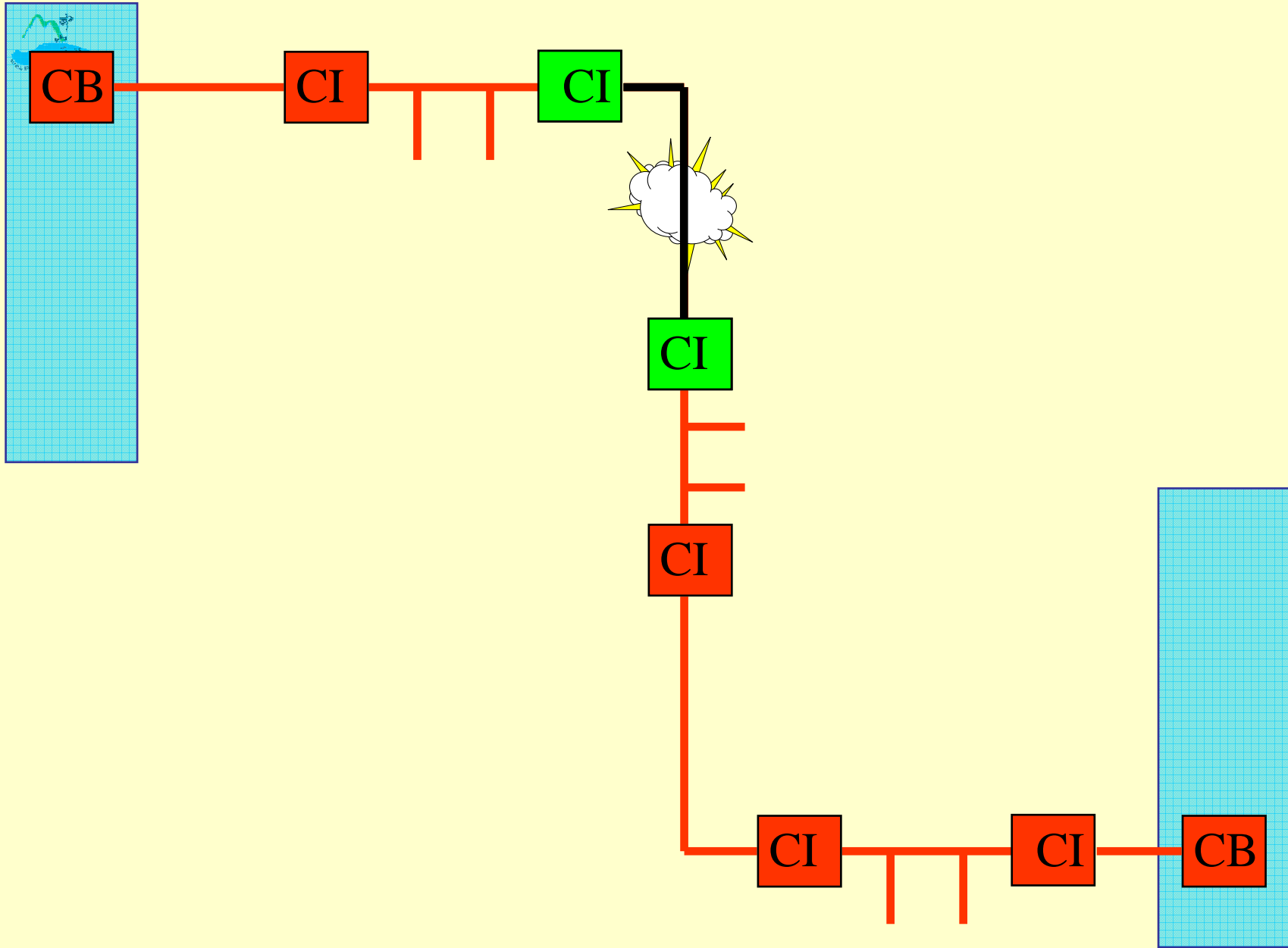
RTU

- Data Acquisition of Substation
 - Power, V, I of Feeders.
 - FCB Status
 - FTU Data Concentration
- FCB Control

FTU

- Data Acquisition of LS (V, I, SW status)
- LS Control

RTU : Remote Terminal Unit
FTU : Feeder Terminal Unit

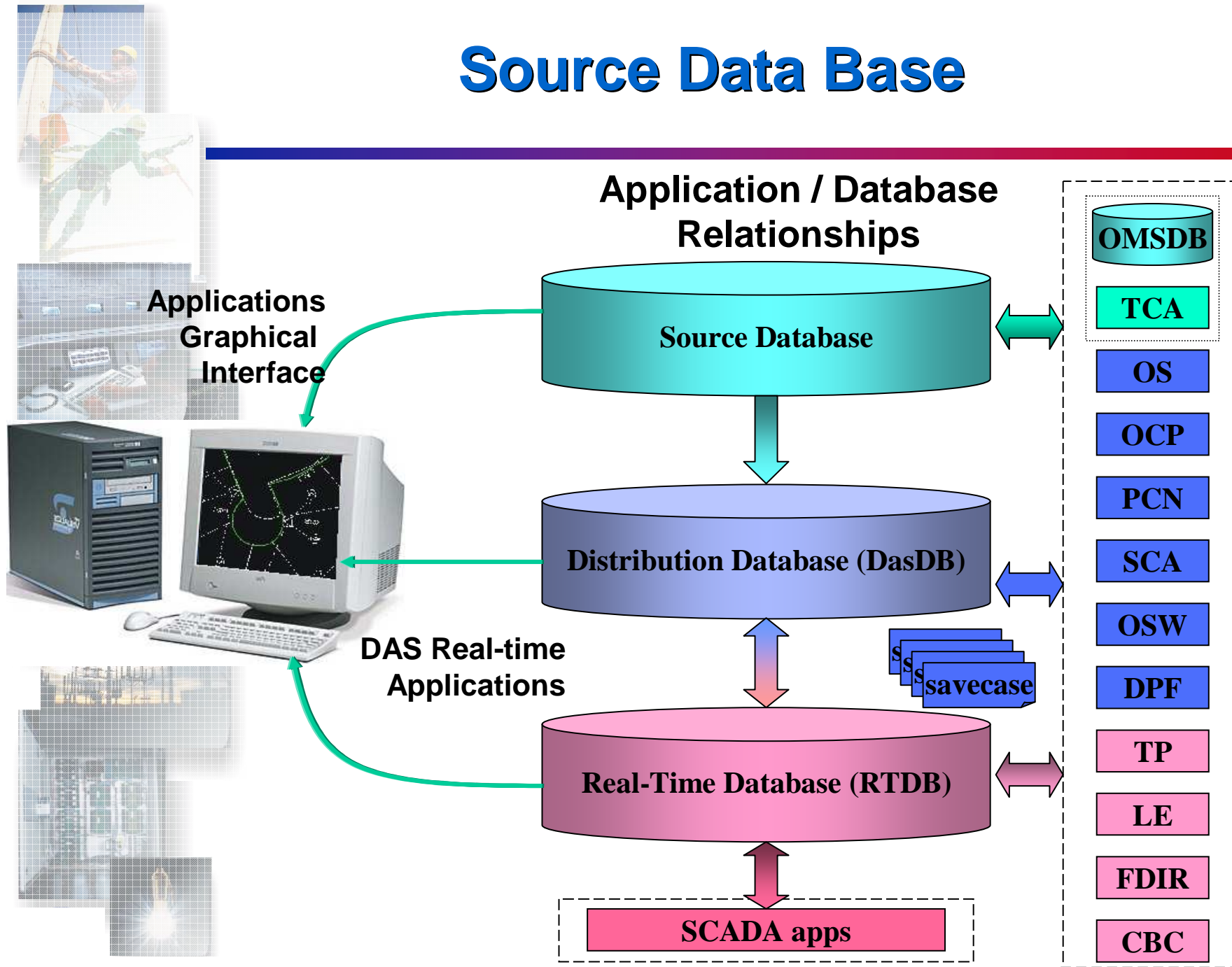




TPC DEMO

Fault Detection Isolation and Restoration

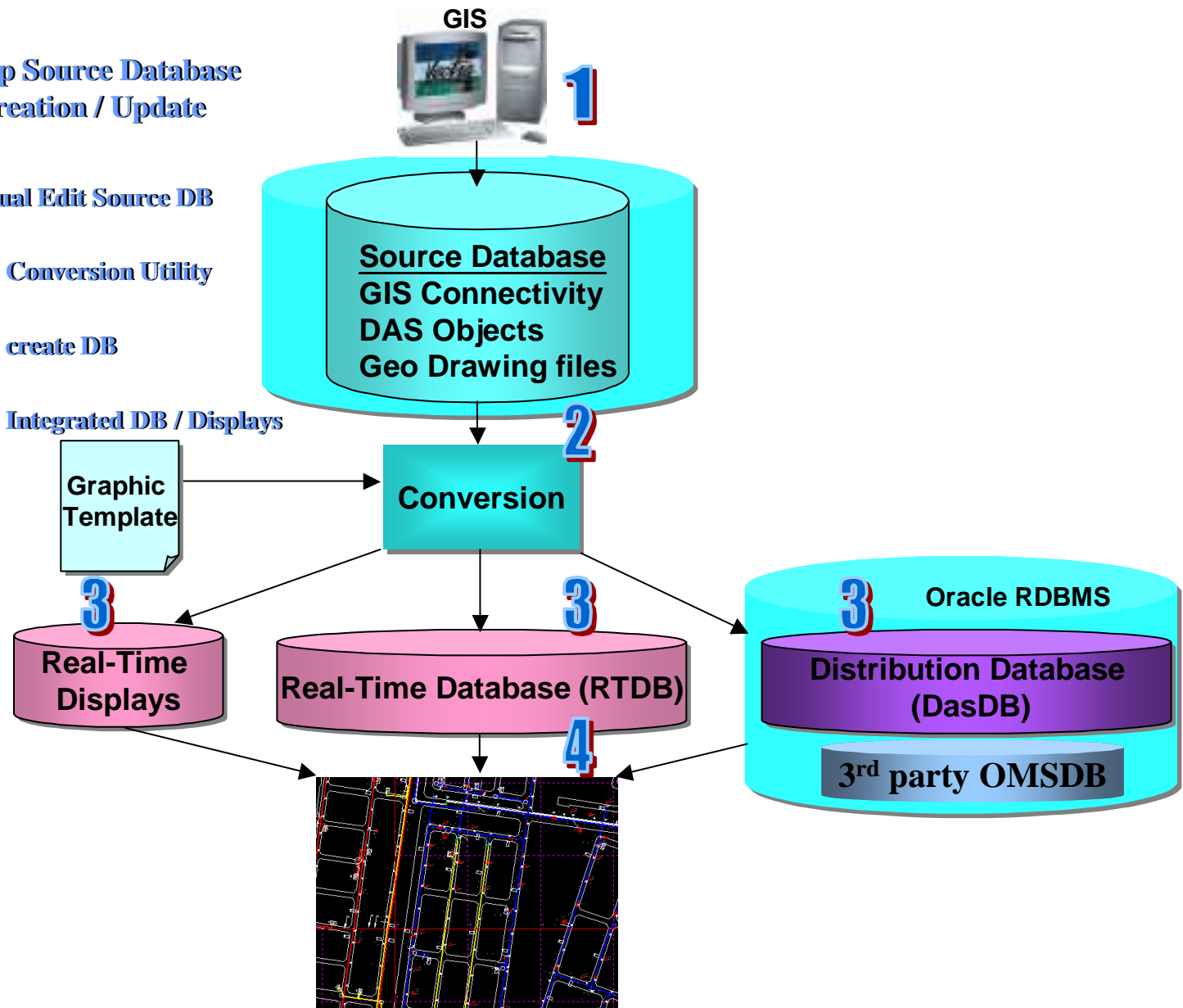
Source Data Base



Source Data Base

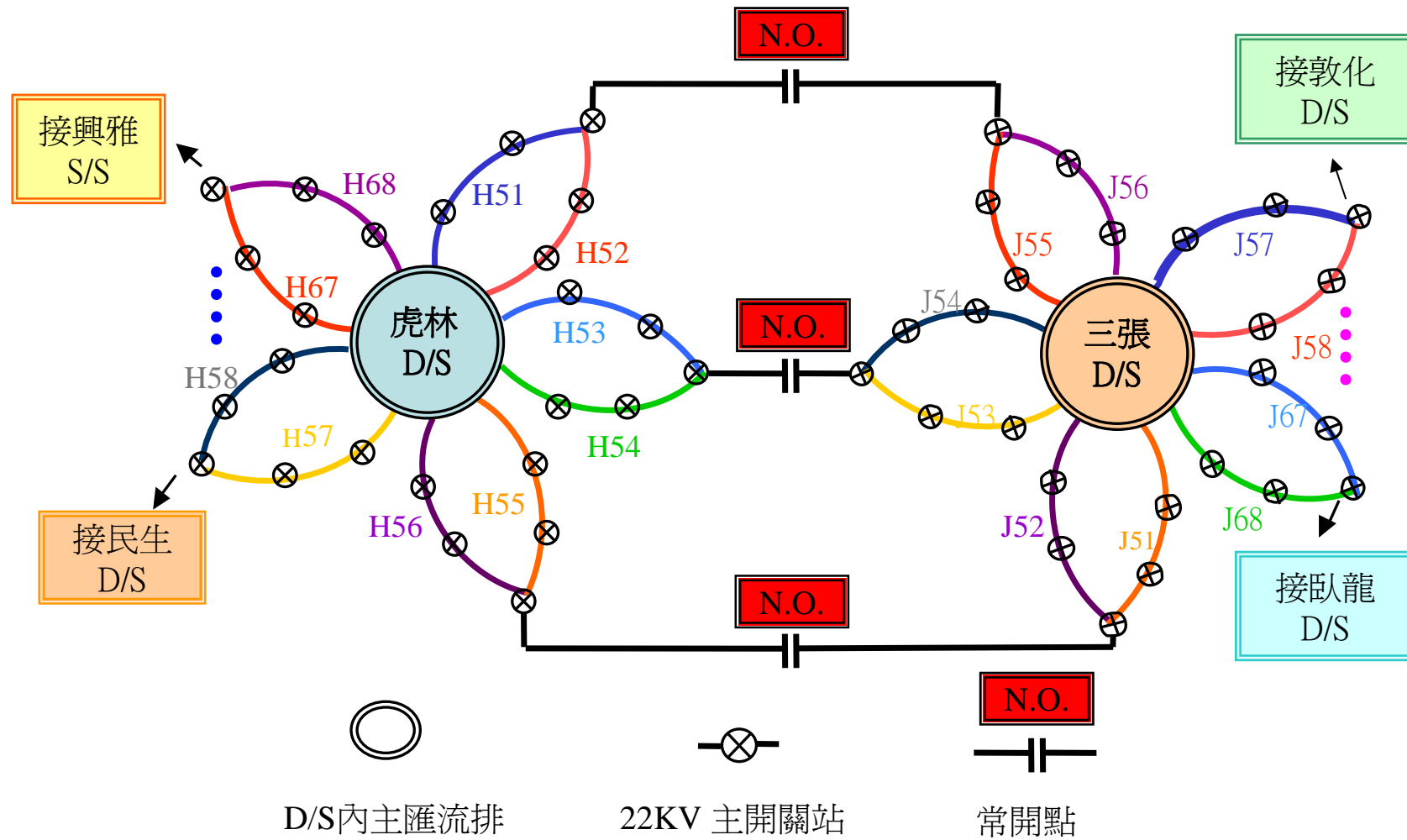
4-step Source Database Creation / Update

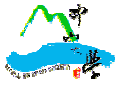
- 1 Manual Edit Source DB
- 2 Auto Conversion Utility
- 3 Auto create DB
- 4 Auto Integrated DB / Displays



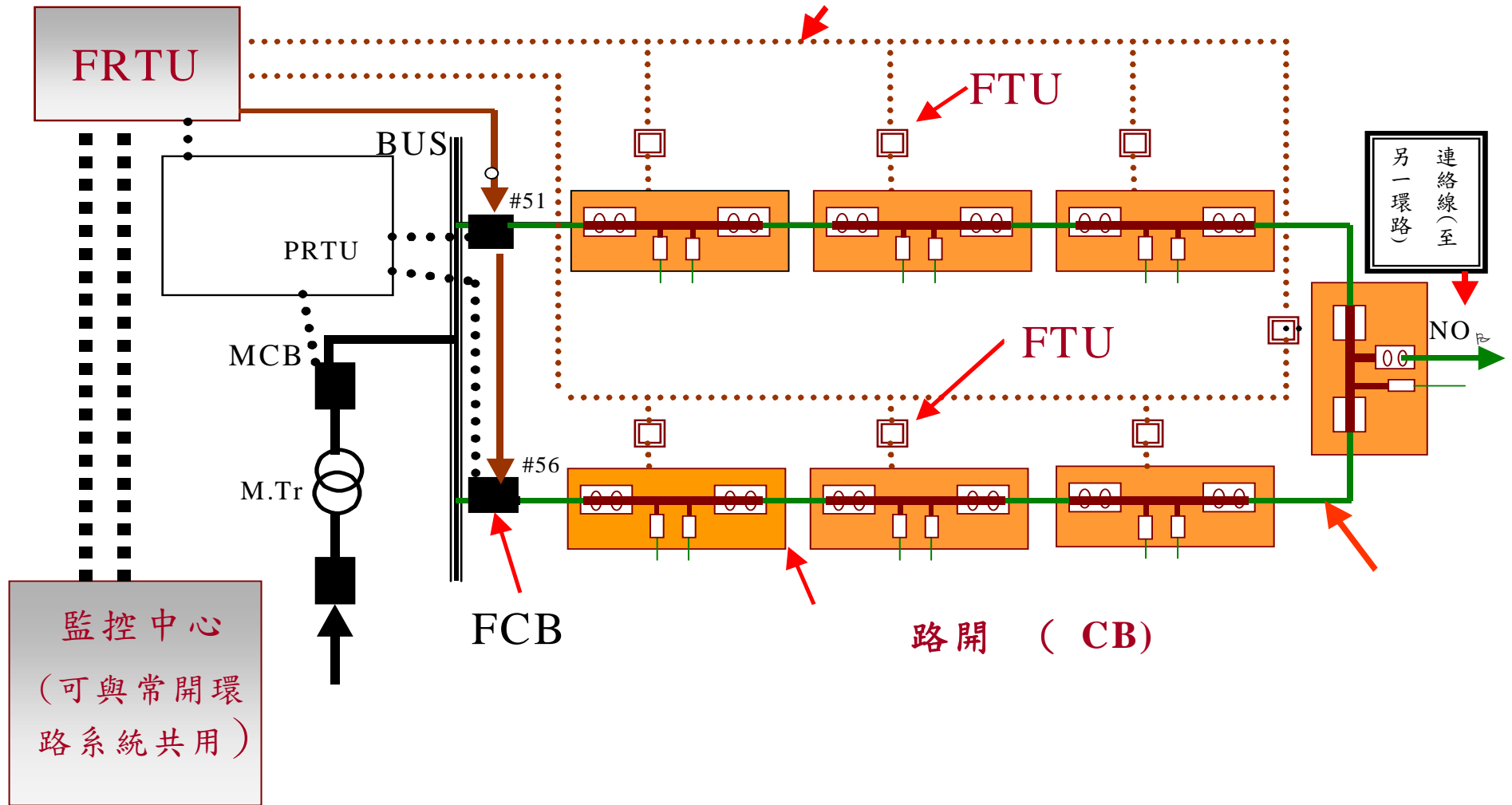


Close Loop System Configuration





Feeder Automation for Close Loop Distribution Systems



Smart Community Alliance



- Necessity of the alliance
Technologies related smart community are spread in wide area. So, alliance of several companies is necessary.
- NEDO is active as the secretariat.



Smart grid element technology: Introduction of a large amount of the renewable energy into market



- In the case of high penetration of renewable energy, energy storage or regulating generators are necessary. Also, generation forecasting method is needed to operate them.
- Power will flow from lower side to upper side, if distributed generator increases. In mesh grid, power flow pattern becomes complicated and becomes difficult to control.
- In the case of switching circuit or recovery of outage, utility must cooperate with distributed generator.
- So, utility may need to communicate with distributed generators.
- Renewable energy has no elasticity against price of electricity. So, it becomes difficult to keep market mechanism when such generators are increased.

Smart grid element technology: Demand side management and Demand response



- From 20 years ago, digital meter was exist. At large scale customer, these digital meters were introduced. In the past, it was not easy to introduced to house hold due to high cost.
- In USA and Europe, demand response was expected that add price elasticity to demand side.
- In Japan, those technologies are very similar to the technologies developed in ECHONET project.
- In clear purpose of smart meter in Japan is remote metering.
- The first idea of demand response appeared in DSM in 80' s.
- However, in 20007s in USA, elasticity was discussed after the confusion of market.
- Effect of DSM was discussed through experiments in 80' s or 90' s, including NEDO project regarding DSM.

Smart grid element technology: Electric vehicle problems

- Electric vehicle is moving demand.
- If you charge EV at home, you can use rate for residential.
- If you charge it at office, you can not know to pay for electricity. Because of principle of contract at one site. Also, in Japan, we can not resell electricity.
- So, EV is charged in office, utility must recognize user of electricity for accounting.
- If a person who live in A utility territory charges EV in B utility territory, some kind of ro system of accounting must be needed.
- V2G may bring new problem. If you can charge EV at office , you can use cheaper electr home by using V2G technology.
- Rapid charger may require additionally larger capacity than 50kW on distribution, so insta of those equipment may bring shortage of distribution capacity.
- Especially, transmission capacity to center of Tokyo is limited, because of limited numbe roads to center of Tokyo. New transmission construction, especially underground cable is difficult due to requirement of very deep tunnel for cable

Smart grid element technology: Grid automation



- Usually, we discuss difference of average outage time between Japan and USA(USA :80minutes and Japan: 5minutes). This difference comes from difference of levels of grid automation.
- In this stage, Japan has advantage about grid automation. However, in future, USA may invest optical fiber and introduce more progressed grid automation system aimed to future high penetration of PV.
- NEDO has experience to introducing power quality control technology in Sendai power supply system with difference power quality project.



Together ... Shaping the Future of Electricity