



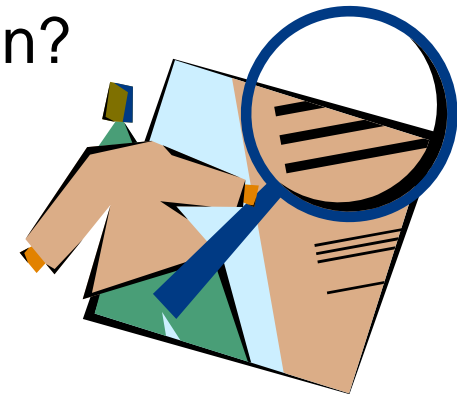
Monitoring Low-Impedance Equipment for BES (Loops, Drops & Short Segments Planning Committee)

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8/11/10

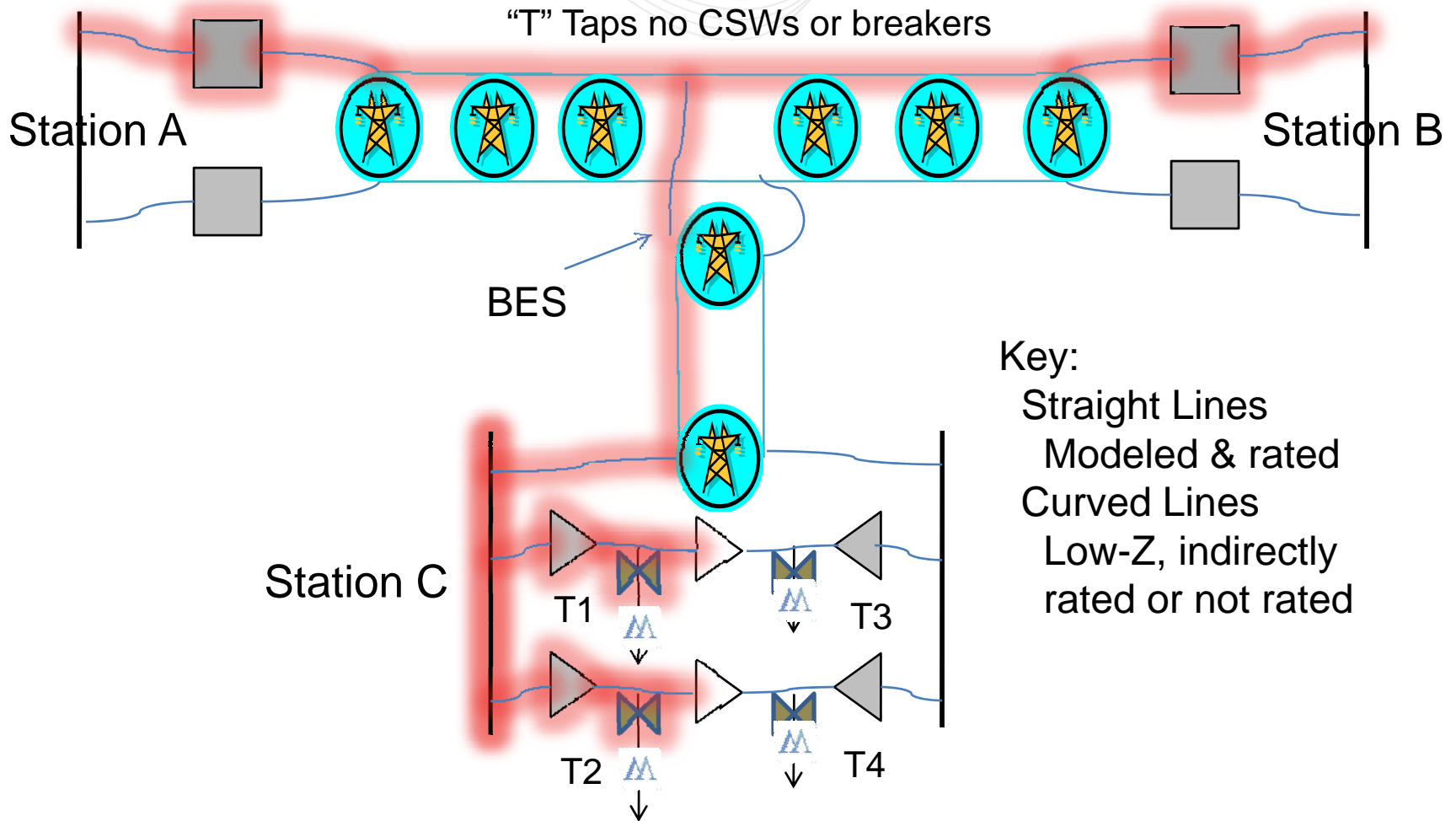
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- Bulk Electric System Definitions
 - Adopted by RFC
 - Adopted by SERC
- How is low Z equipment managed/monitored?
 - What details have to be modeled for BES?
 - What details have to be monitored for BES?
 - Who performs the monitoring function?



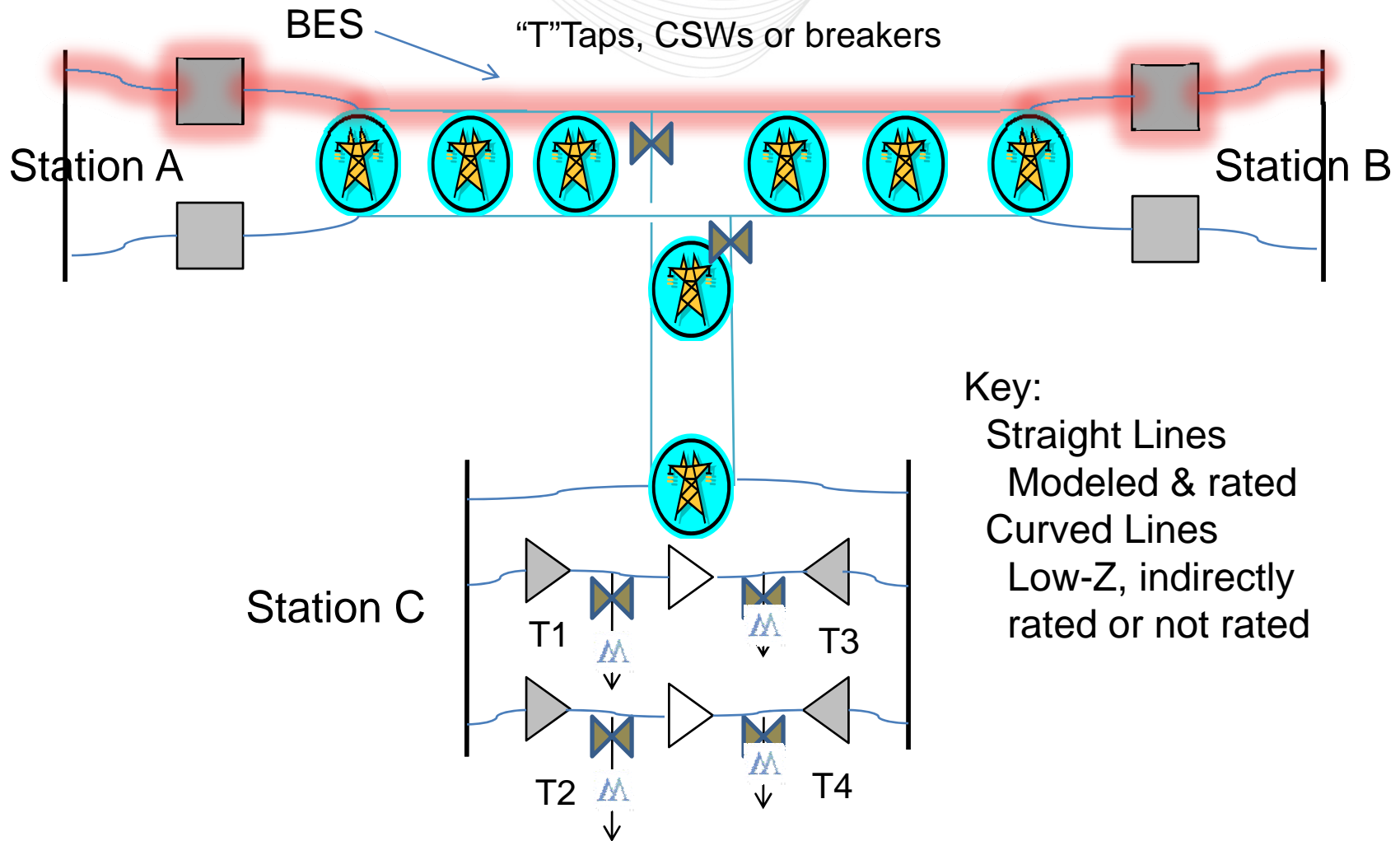


100+ kV BES Elements - T Taps, no CSWs

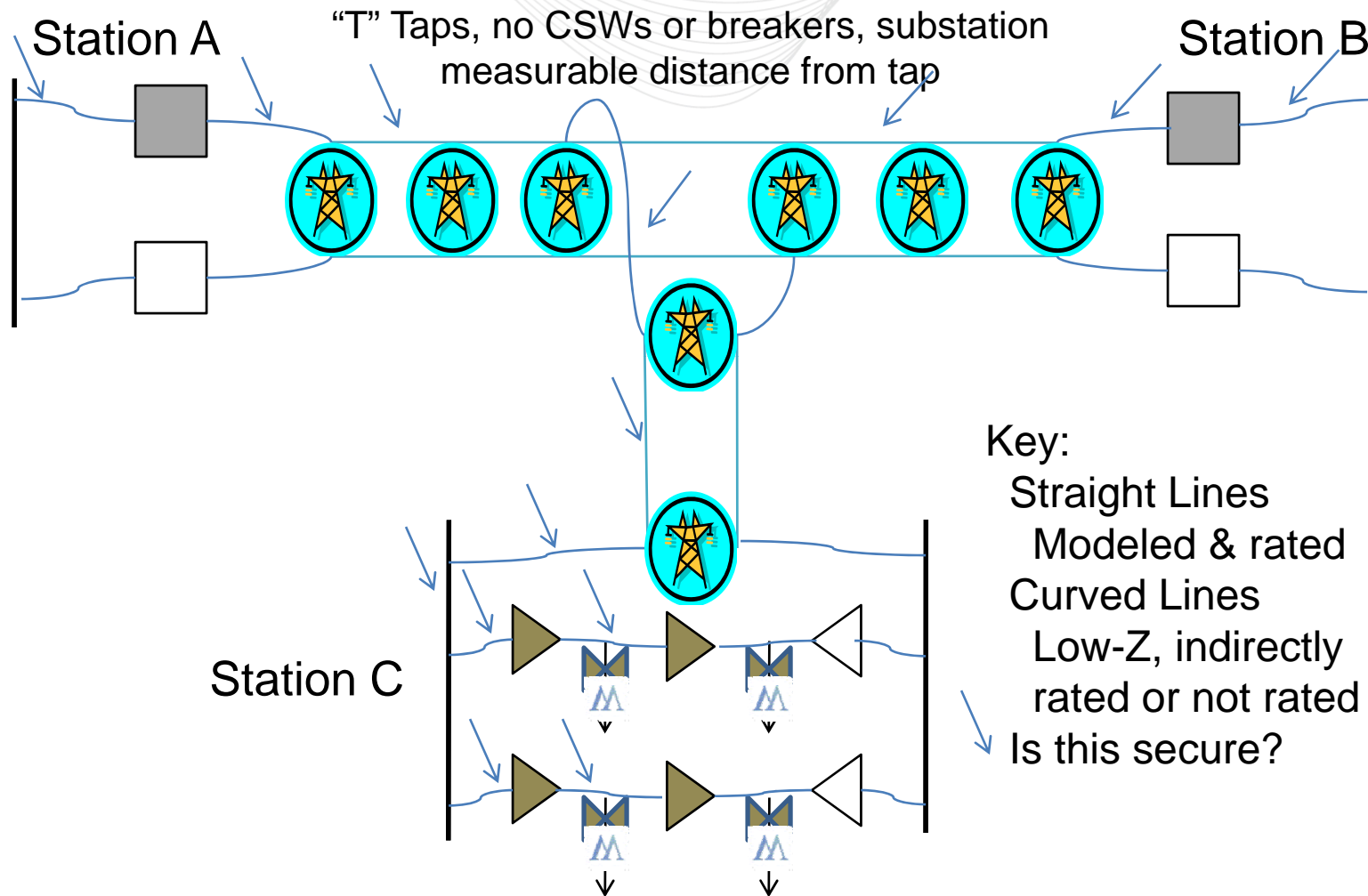




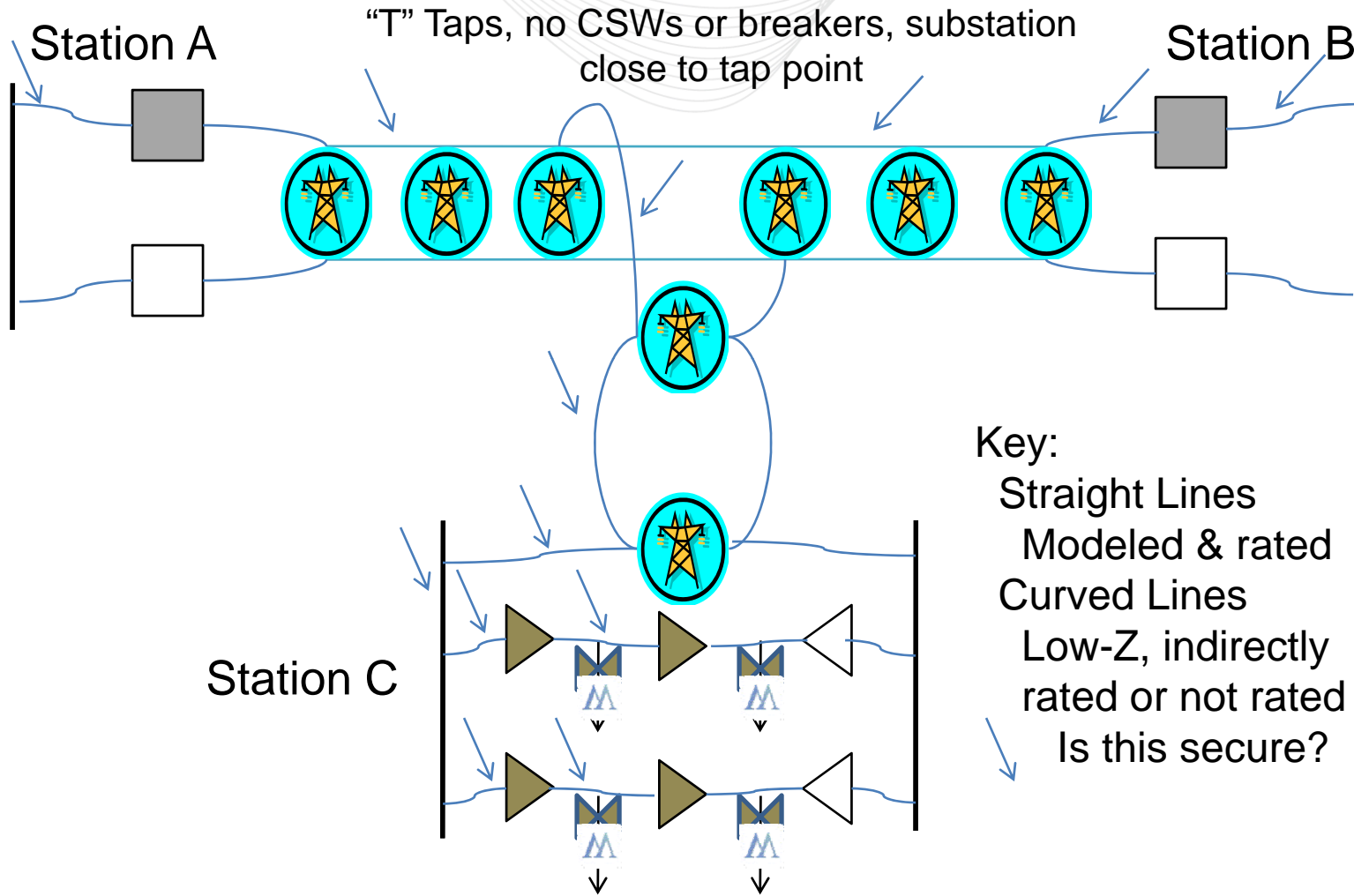
100+ kV BES Elements – CSWs or breakers



100+ kV Loop/Drop/Low-Z Lines



100+ kV Loop/Drop/Low-Z Lines



- PJM EMS Model and Security Analysis Philosophy
 - Focus on security of **Wide Area Network**
 - Based on lumped parameter analysis, assuming constant 60 hertz
 - Cannot calculate flow directly for zero Z equipment (loops, drops, breakers, switches)
 - SE/SA solution stability is essential
 - Throughput for large system solution must be maximized
 - Model needs to be kept simplified
 - Not practical to deploy numerous low-Z devices
 - Representation of numerous, non-physical devices may clutter up 1-lines
 - Inappropriate use of low-Z devices may cause numerical instability
 - Casual deployment of numerous, low-Z devices may obscure major problems
 - PJM SE solution used to monitor loading and security, not metered points
- References
 - M3A Energy Mgt. System (EMS) Model Updates & Quality Assurance (QA)
<http://www.pjm.com/~media/documents/manuals/m3a.ashx>

PJM proposes a 'Tiered' approach

- Tier 1: Long term
 - PJM & TO Planning criteria (or TSS Design criteria) to be reviewed to determine what measures, if any, should be taken to ensure ability to serve load at each substation
 - Plan to install interrupting devices at tap locations to remove from BES or other mitigation procedures
- Tier 2: Insufficient lead time for Tier 1
 - Add telemetry to locations of concern if shifting loads is not practical
 - Assess if low-Z series devices are needed in PJM model and evaluate impact on SE/SA solution (lead time is 3+ months)
 - Add low-Z series devices to internal TO SEs for monitoring
- Tier 3: Immediate options
 - PJM to model, where practical, and use SE/SA results to monitor for overloading
 - TO will shift distribution loads to eliminate overload potential
 - TO to staff locations of concern as conditions warrant
 - To to develop measures to serve as TO EMS alarm points