

#### Workshop on Smart Grid Technologies and Implications for Inclusive Development in Sri Lanka

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# Session 4: Research and development for smart grid innovation – the **other** network R&D

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- The future grid will be a federation of cooperating sinks and sources of great diversity in terms of functionality, capacity & reliability
- **Security** only those that should, have access
- Privacy information is only shared on a need to know basis, and for specific purposes only
- *Traceability* auditing function, regulatory function
- **Complexity** many more actors, many more services
- *Sensors* ubiquity of physical measurements!



# New technologies & Hard constraints

- Internet-of-things? intelligent interconnected infrastructure (but protocol, cloud reliability, interoperability, sensorML, security vulnerabilities) ... a long way to go, no standards as yet
- **Blockchain & crypto-anchors** public-private keys encryption of "random" markers provide traceability BUT social acceptability, and personal responsibility are "stumbling blocks"
- Cloud services on request data broker, sensor data translator, integrator, modelling, financial/weather/domain forecasting (ubiquitous (virtual & real) data networks)



## Evolution to IoT Services over Distributed Cloud



# New technologies & Hard constraints

- An AC network requires all power to be balanced with voltage limits and frequency stability and to remain so despite temporal & spatial changes in topology, demand and supply
- Diversity, distributed generation, and intermittency make this harder than ever = more measurements & models (as electricity works at the speed of light) = more rules & regulations for what can (dis)connect and under what constraints
- The real research question here is: What are the new & evolving network connectivity rules?



# Sobering words from IEEE

 IEEE/CIGRE latest task force on power system stability admits: At an equilibrium set, a power system may be stable for a given (large) physical disturbance, and unstable for another. It is impractical and uneconomical to design power systems to be stable for every possible disturbance.

