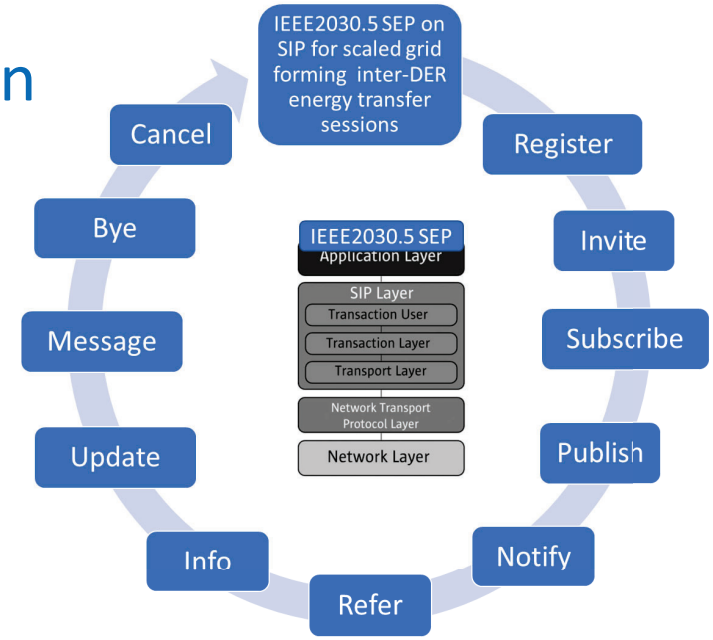
Distributed Energy Control at Scale Challenge

Glenn Algie
Energy IoT Engineer

- Glenn Algie is an Energy IoT Solutions Architect with AT&T Business IoT Professional Services Group.
- In his current role, he is designing and implementing advanced multisite end-end behind-the-meter energy IoT solutions for application in the enterprise building market segment.
- He has over 28 years of experience in telecommunications research and edge Platforms development at BNR/Nortel, where he has made multiple contributions to the IEEE 802 and 1588 standards, including other control and user plane contributions in the digital transformation of multimedia.
- In addition, Algie's experience includes 15 years of developing AI-driven mobile, IoT and energy multiservice convergence gateway platforms.
- He holds several patents in the area of communication protocols, AI and IoT and Energy – in progress. He graduated with a BS in Electrical Engineering from the University of Toronto, Canada. He also has a DER (Distributed Energy Resource) communications certificate from the University of California San Diego. Working towards power engineering certificate

Topics

- Common dimensions of Energy and Media
- SIP layer 4 brief background
- SIP core signals of reuse for energy option
- 2030.5 over SIP walkthrough
  - Discovery
  - Setup, renegotiate, teardown
- IEEE PES Call to action/next steps
- Q&A



Common dimensions of Distributed Energy & Distributed Multimedia :

- Generate
- Store
- Adapt
- Consume
- *Distribute*

A Brief SIP history – relevant to Energy scope:

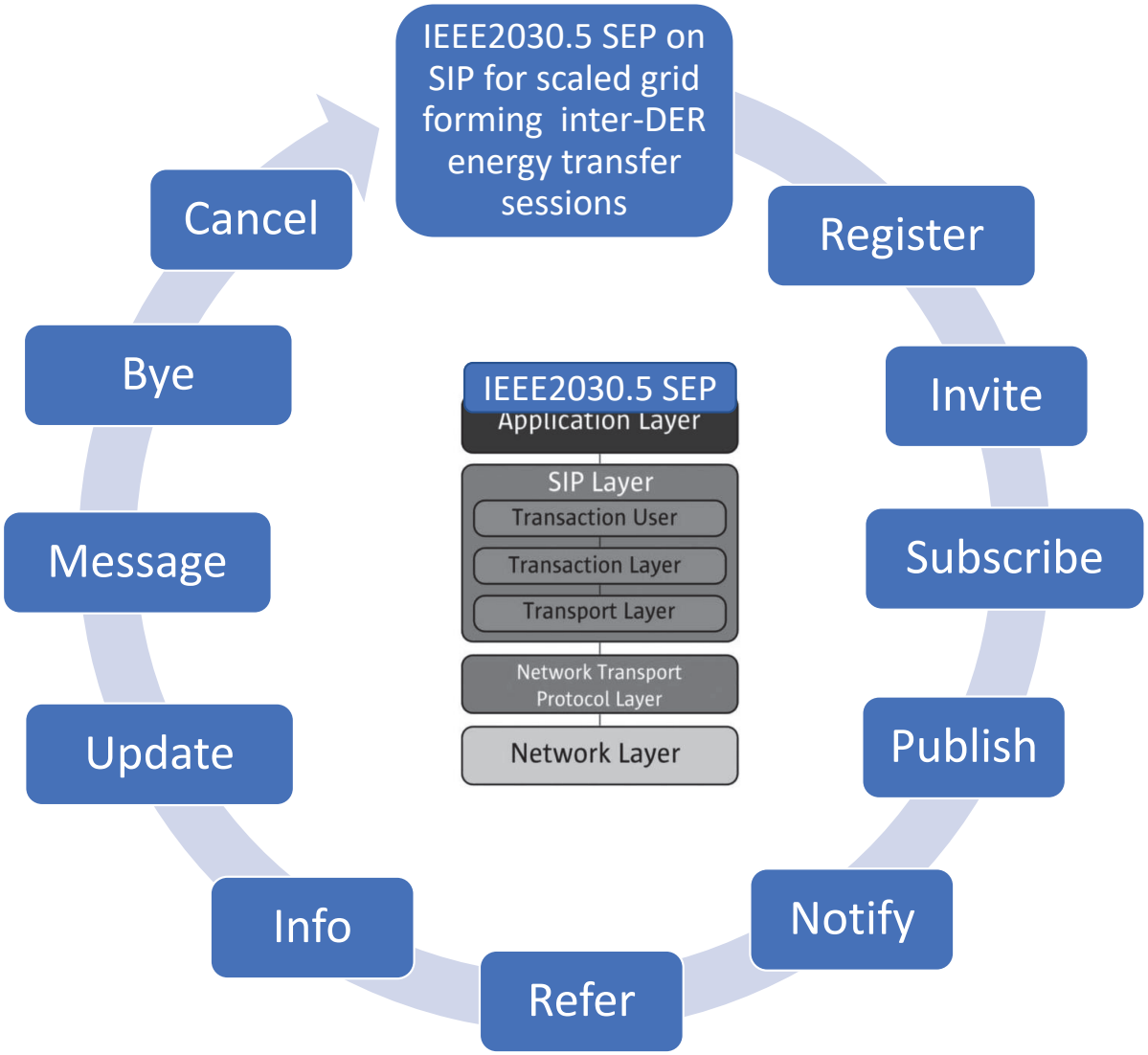
- Session Initiation Protocol, SIP (RFC 3261) many iterations , grew to 11 useful signals for layer 4 option for Smart Energy Profile layer 5
- SIP and MQTT emerged in late 90's - Telecom industry vs OIL and Gas industry control planes
- Original drivers were Lucent, AT&T. Ericsson and others (Nortel Networks) - Megaco, MGCP roots in mid 90's
- SIP signals grew over initial years to 11 signals of interest – a number of IETF RFC papers cover details
- IP Multimedia Subsystem decoupled to IMS layer 5 describes multimedia bearer plane session transfer specifics , decoupling from SIP layer 4 – Energy enabler!
- A Streamlined software control plane among 2 or more networked edges involved to transfer a resource. IMS media specific decoupled to layer 5 vs SIP at layer 4 not media specific
- Globally deployed over 20 years, scoping beyond Telco Multimedia includes but not limited to Telephony, Mobile 3/5G RAN, IPTV
- H.771 SIP IPTV integration uses cases may be most like that of Energy. Steps of Discovery Negotiate, Setup, Renegotiate, add endpoints Teardown

More on SIP – relevant to smart inter-DER energy transfer session

- Policy server CSCF (Call Server Control Function)
- Session oriented proactive transfer of a time-oriented resource moved between 2 or more endpoints over a common shared bearer plane.
- mediates/steers/firewalls many overlapping Session setups and teardowns at scale - thousands of proactive call admission media transfer sessions mediated per second.
- Optional sub control channel microsecond level bearer specific for inter DSP communication between for example generate and consume DSP computational resources in the Edge node. Use of precision synchronization and time may be handy , example in media is H.265 inter DSP communication control stream generate edge to consume/adapt/store edges

SIP core signals

- TARGETING: Next gen grid forming DER control plane gaps – flatten networking of energy inter DER controls via DER GW controller
- SIP Energy example with Energy specific bearer/control
  - SIP shim under IEEE2030.5 for grid forming inter-DER added option
  - SIP “E-CSCF “ energy mediation server(s) policy controls from Community & Utiiity via IEEE2030.5
  - Muti DER 2 or more SIP based Energy Session
- Call for interest/collaboration : 1-3 1 hr meets - flush out SIP value added portions, go/nogo 2030.5 on SIP POC
- IETF and ITU RFC for IP Energy Subsystem , “IES” on SIP, SDP SEP2.0 (2030.5) extension – identify easy vs gaps, challenges
- OPENFMB , OPENADR –explore, ratify, integrate SIP as optional inter DER proactive energy transfer control session



Opportunity for SEP2 over SIP layer 4 option

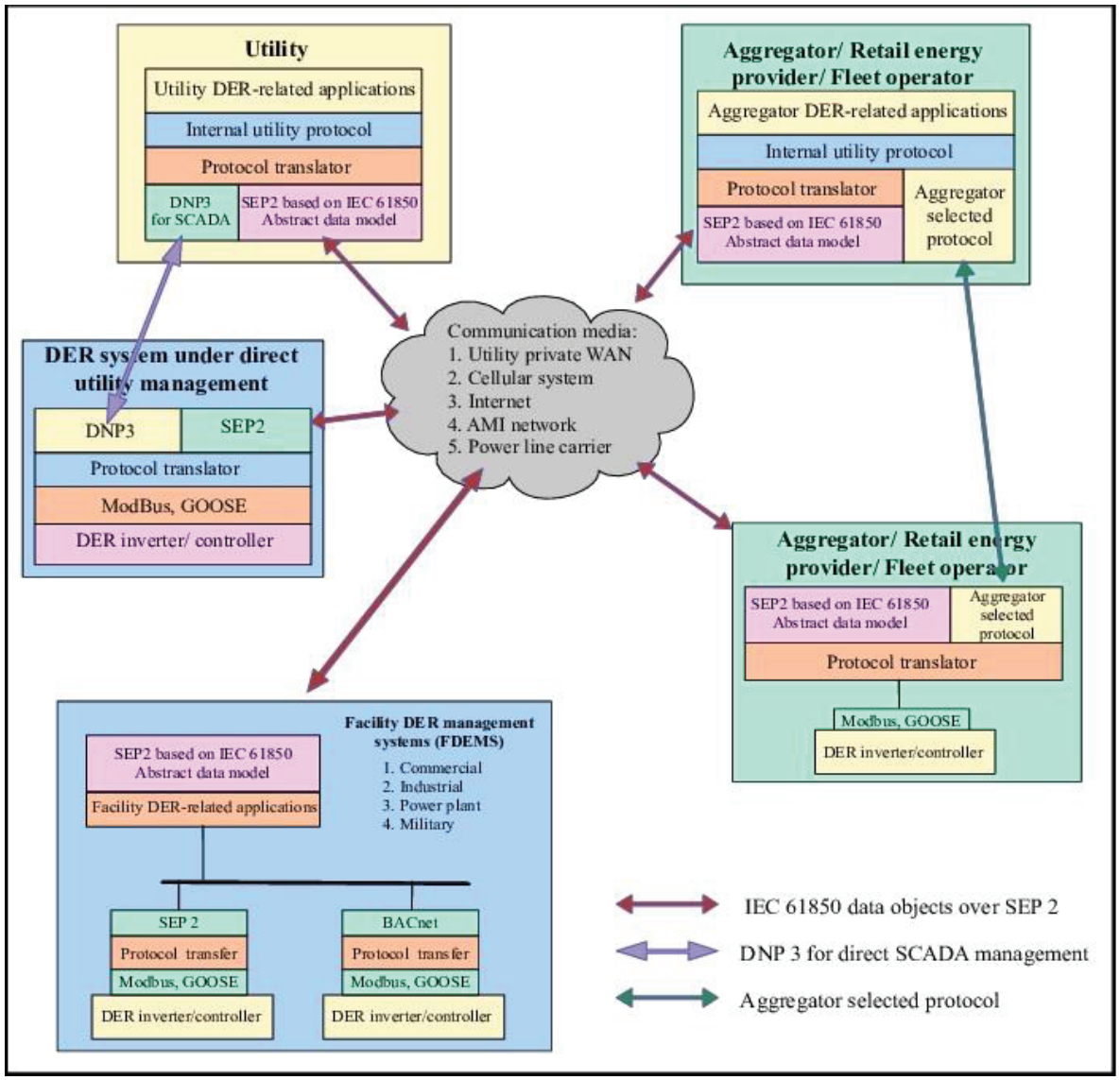
Results in new opton for a proactive call admission control of energy transfers on proven scaled standard session oriented resource transfer layer 4

Scope for SIP option:intelligent grid-forming next gen DER edges able to scale with flat somewhat autonomous energy transfer (SIP CSCF policy mediated oversight)

Terms:

“2030.5 over SIP”

“SEP 2 over SIP”



SIP examples today - Layer 4 + 5 IMS IP Multimedia Subsystem

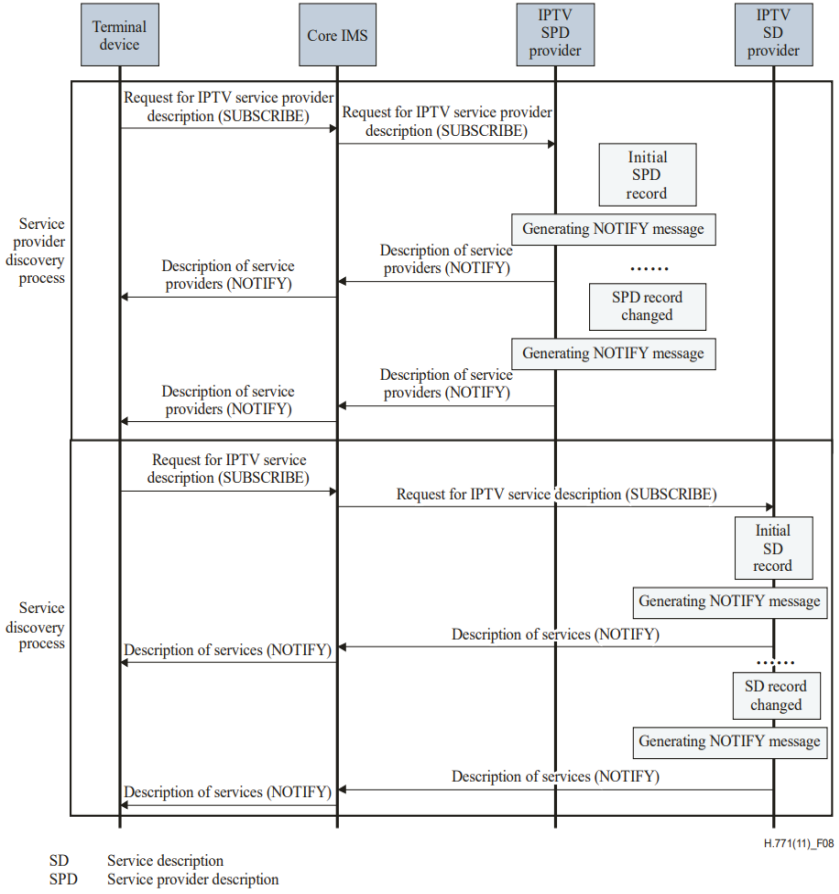
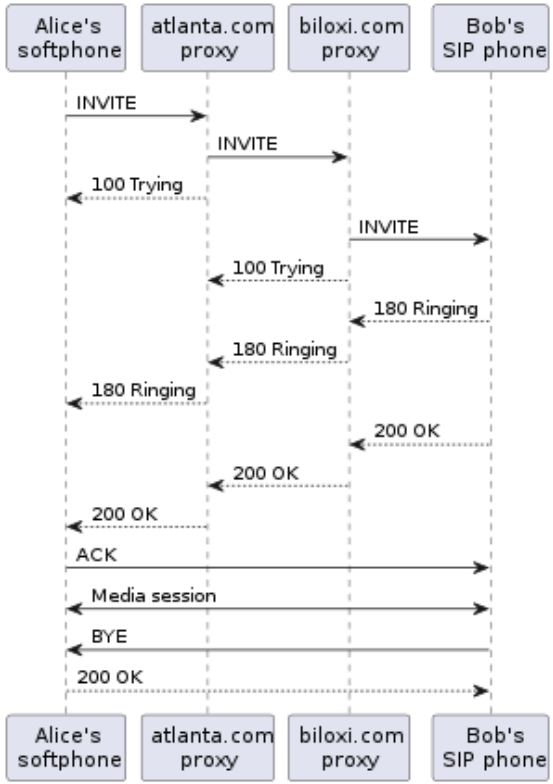


Figure 8 – Flows for retrieving the description of the available IPTV services via core IMS

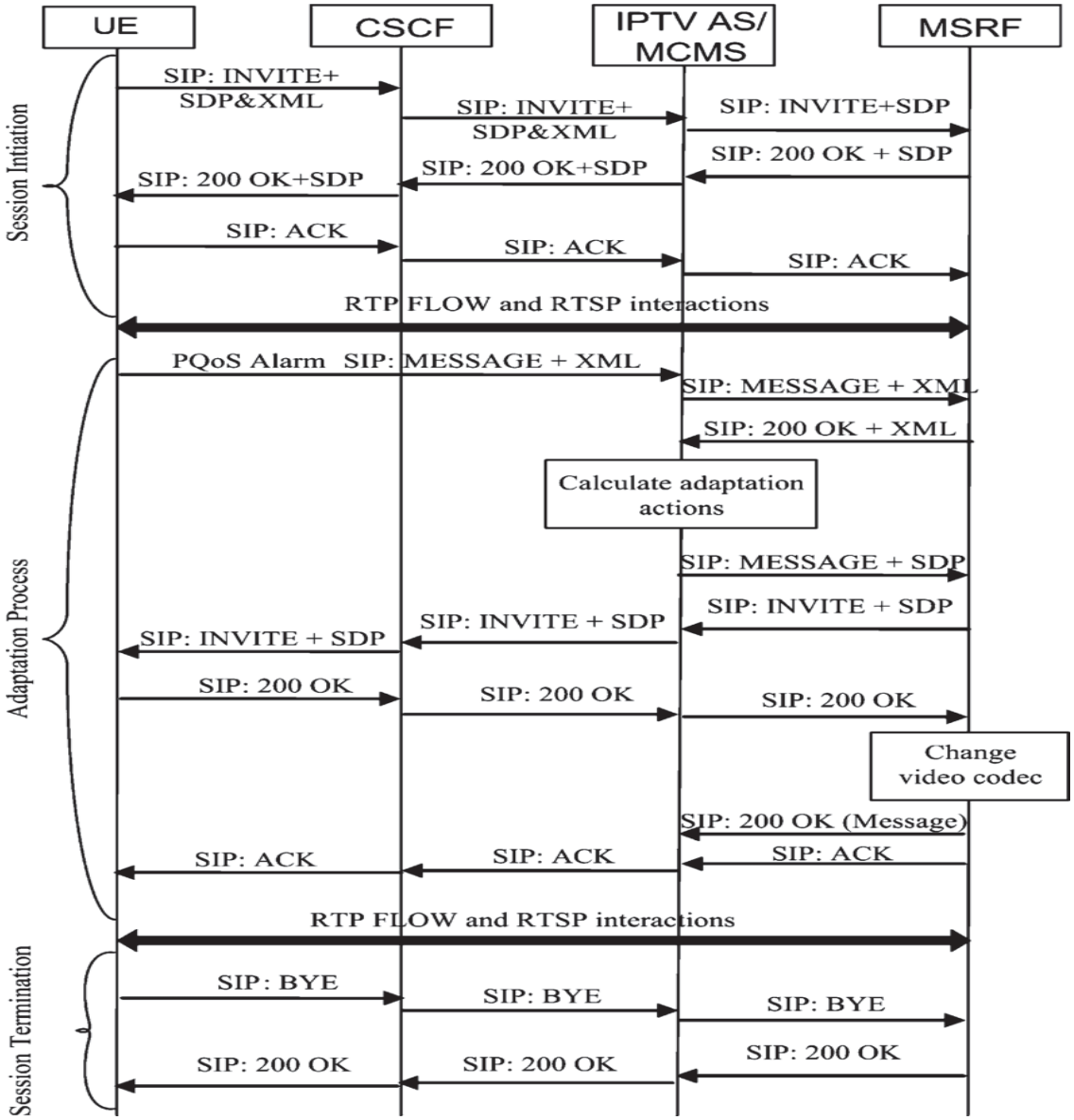
Ref: ITU H.771 IPTV over SIP

Ref: Wikipedia definition of SIP



SEP2 IEEE2030.5 can be IP Energy Subsystem layer 5

Example of ITU H.771:
IPTV over SIP is good example for energy like use case
- Discovery
- Negotiate
- Renegotiate to storage
- Later retrieve form storage



SIP Session Oriented Energy Transfer Control - discussion items

- **IF INTEREST TO COLLABORATE – next is 1 hour teams/zoom workshop to walkthrough Energy over SIP example UML**
- **Smart grid-forming DER edges SIP Register to Energy-CSCF Policy server**
- **SIP Discovery phase via DER services pub/sub/notify – SIP Policy server influences scope**
- **Advertise capability/offers – SIP CSCF Policy server may influence scope of energy, disallow, request teardown etc.**
- **Initiate SIP layer energy transfer session, report on transfer session, add/remove endpoints, renegotiate policy via Energy-CSCF**
- **2 or more to many endpoints dynamically add/drop in the transfer session, renegotiable via SIP SDP**
  - **Dynamic session (re)Negotiate bearer(s) – SDP extended with IEEE2030.5 Smart Energy Profile mapped into SIP SDP name space**
- **Behind the meter vs Front of the meter negotiation**
  - **Reuse of SIP Lines vs SIP Trunks concepts = behnd the meter (site gateway) vs Front of the meter**
- **Renegotiate transfer session – i.e. some similar multileg use cases of media transfer = energy transfer**
  - **Add more generation and storage sources to larger consumption demand surge**
  - **Redirect all/portion of SIP transfer session to storage, pull from storage later.**

Integration and interworking with OPENADR, OPENFMB

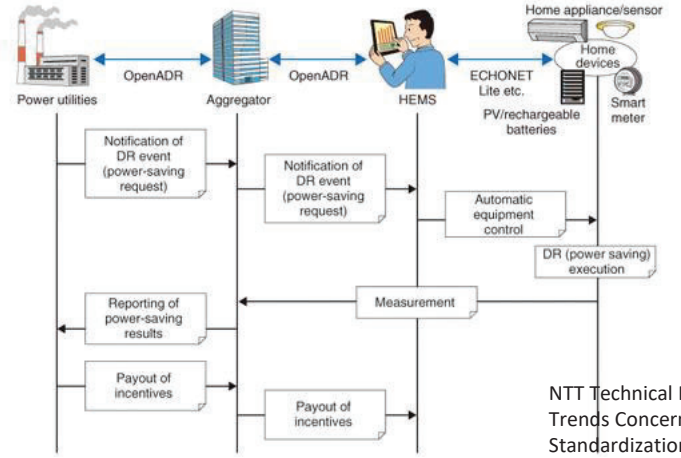
OPENADR

- **Demand response via prices to devices**
- **SIP CSCF policy server dynamic interop**
  - **Prices to devices**
  - **Power saving requests**
  - **SIP policy control can deny or throttle future sessions and negotiate down existing session distribution feeder allocations across sessions**

OPENFMB

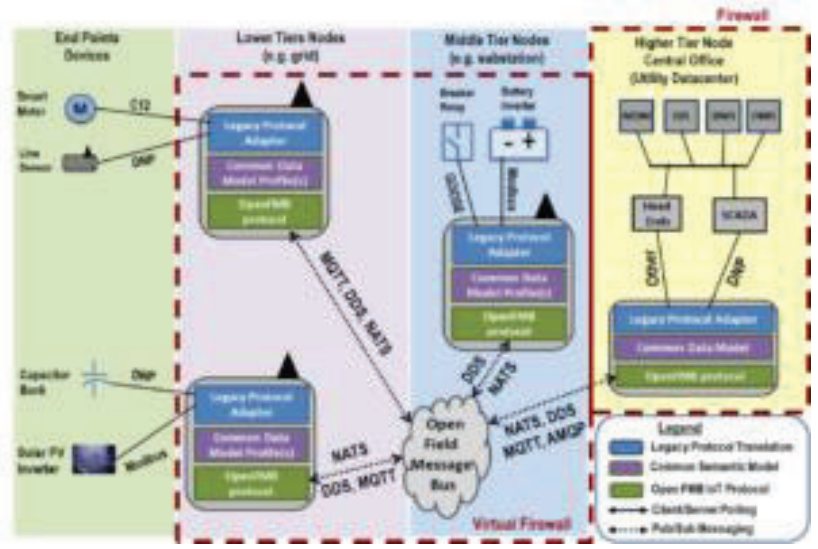
- **Interops with Grid edge intelligence scaling and layering**
- **MQTT and mDNS interops in SIP Layer 4 today**

SIP ihas deployed opensource for direct mqtt interop, SIP has signals of pub/sub/notify used for discovery, and mDNS



ECHONET: Energy Conservation and Homecare Network
HEMS: home energy management system
PV: photovoltaic

NTT Technical Review, 2013
Trends Concerning Standardization of OpenADR - Ryutaro Toji



Next Steps, call to actions

CONTACT DETAILS

ga372x@att.com, +1 6507798465

glennalgie@gmail.com , +1 4088339313

Call for interest from attendees?

- **IEEE PES Birds of a Feather meeting next?**

Offer: 1-3 * 1 hour Teams video conf calls

- **LEVEL SET ON SIP – walkthroughs**
- **Discuss/whiteboard/Walkthrough inter-DER SIP using import of IEEE2030.5 descriptors to SIP SDP descriptors**
- **Propose initial use case scopes for "IP Energy Subsystem" on SIP**
- **OPENADR/OPENFMB interop, layering**
- **Leverage IMS on SIP model for IES on SIP, SIP IES vs SIP IMS delta captures**
- **Live SIP sandbox control plane to DER vendor labs**
- **Identify opensource SIP stacks for reuse**
- **SIP sandbox live demo – energy transfer 3-4 endpoints**
- **Joint RFC into IETF and ITU-T**

- **SIP IES SDP definitions**
  - **Export IEEE2030.5 namespace and descriptions**
  - **Live SIP sandbox control plane to inter DER interop demo.**

- Call for interest, call for comment
- IETF/ITU RFC – needs ecosystem coauthers
- OPENADR/OPENFMB explore as added inter-DER option – 2-3 meetings, 90-120 day SIP Energy subsystem POC 4 DER endpoints then decide accept, reject, iterate
- Contractual aspects of Energy-CSCF Distribution grid policy constraints

  Balanced cooperative mix of COMMUNITY & UTILITY energy control policies
- VPP Virtual power plant enablers – control services wrapper – Thermostat aggregate controls
- Pushback on gaps
- Initial use cases to target
- **Live multivendor DER grid forming SIP sandbox interest**

References

- https://en.wikipedia.org/wiki/Session_Initiation_Protocol
- https://en.wikipedia.org/wiki/Jonathan_Rosenberg_(SIP_author)
- https://en.wikipedia.org/wiki/SIP_extensions_for_the_IP_Multimedia_Subsystem
- https://www.tutorialspoint.com/session_initiation_protocol/session_initiation_protocol_sdp.htm
- https://github.com/epri-dev/IEEE-2030.5-Client/blob/master/client.md
- https://www.qualitylogic.com/wp-content/uploads/2021/05/GEI-Mini-Forum-2030.5.pdf