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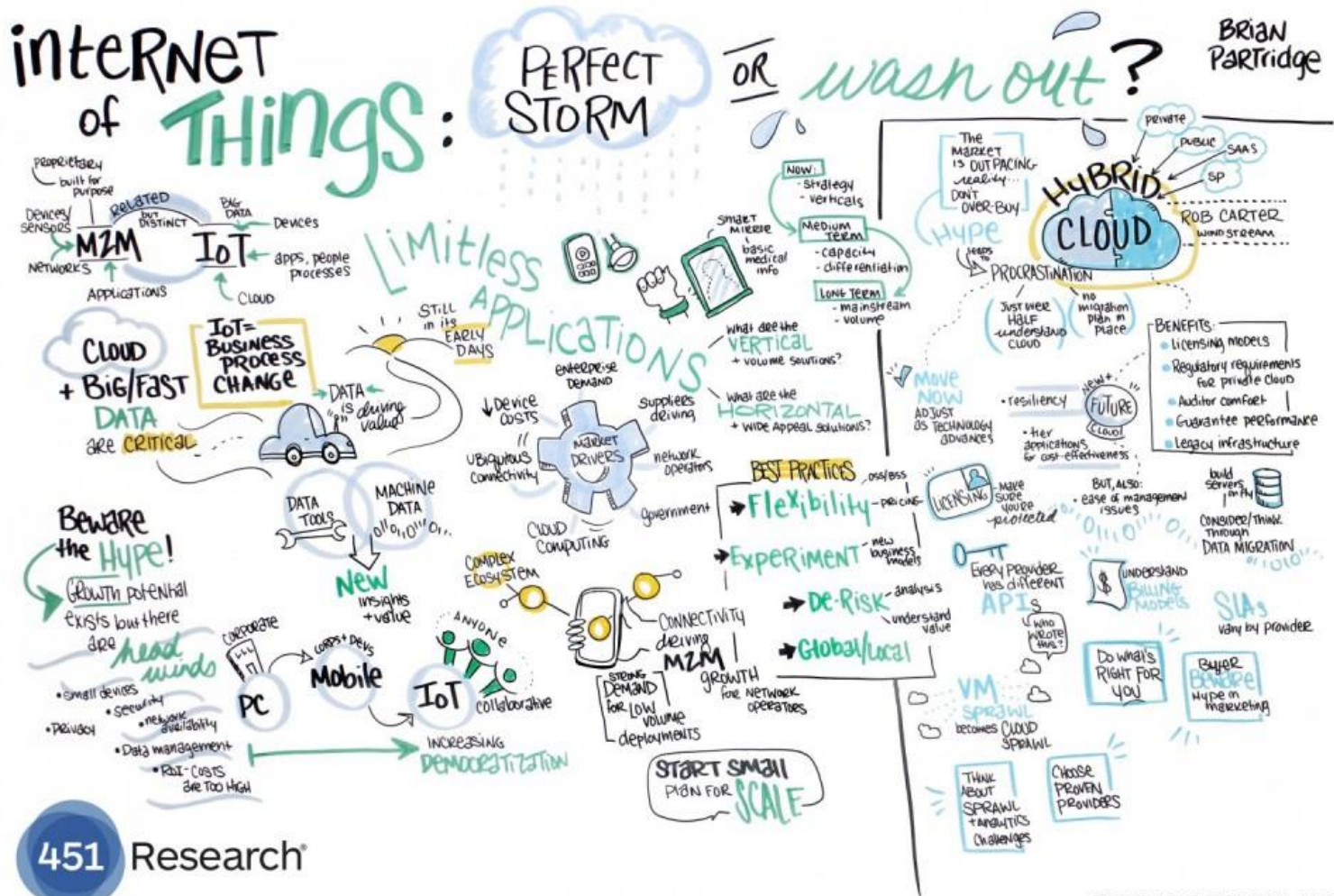
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Trinidad & Tobago **MULTISTAKEHOLDER**
Advisory Group

Standards Perspective: Big Data and IoT

Promoting interoperability via Open
Standards, and Semantic
Technologies

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- What is IoT ?
- What is Big Data ?
- History Lesson
- Pre Standardisation
- Challenges/Benefits
- During Standards formation
- Post Standardisation
- Alliances/bodies involved in standards
- What standards in our region
- Regional standards adoption





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What is IoT ?



- an extension of the internet as we knew it
- more and more devices being connected to the internet
- from temperature probes to cars analytics, health devices taking realtime data



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What is Big Data ?

Big data is a term that describes the large volume of data , both structured and unstructured that has the potential to be mined for information





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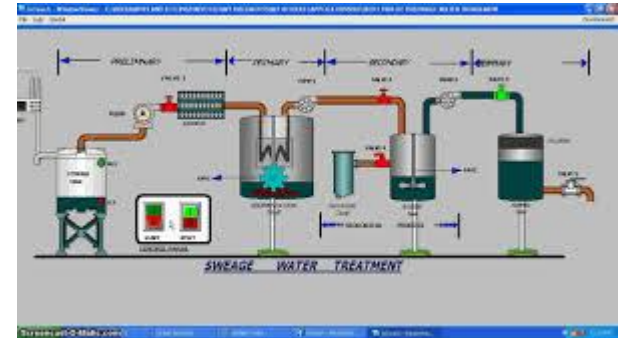
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Big Data Landscape 2016 (Version 3.0)

Infrastructure				Analytics				Applications			
Hadoop On-Premise cloudera, Hortonworks, MAAPR, Pivotal, IBM InfoSphere, bluedata, jethro	Hadoop in the Cloud amazon, Microsoft Azure, Google Cloud Platform, IBM InfoSphere, CAZENA, TREASURE DATA, altiscale, DUBOLE	Spark databricks, GridGain, TACHYON, NEXUS	Cluster Services amazon, kubernetes, HPEC SYSTEMS, docteur, MESOSPHERE, Core OS, stackIO	Analyst Platforms Palantir, AYASDI, Quid, enigma, Digital Reasoning, ORBITALINSIGHTS	Analytics Platforms Microsoft, guAVUS, Datameer, Bottlenose, interjona	Data Science Platforms context relevant, ALPINE, DataRobot, MODE, plotly, yhat, DOMINO, sense, ALGORITHMIA	Visualization tableau, Google Cloud Platform, Qlik, looker, Roambi, dataroma, CHARTIO	Sales & Marketing RADIUS, Gainsight, bloomreach, Zeta, bluestring, livefyre, blueyonder, Lattice, kahuna, infer, SAILTHRU, persado, AVISO, sense, QUANTIFIND, ACTIONIQ, fusemachines, ENGAGIO	Customer Service MEDALLIA, ATTENTIVITY, CLARABRIDGE, CLICKFOX, STELLAService, NGDATA, Preact, DigitalGenius, appur, Wiseio	Human Capital gild, Connectifier, entelo, hiQ	Legal RAVEL, JUDICATA, Everlaw, Brevia, PRESENTPOINT
NoSQL Databases amazon, Oracle, Microsoft Azure, mongoDB, DATASTAX, <EROSPIKE, Couchbase, SequoiaDB, redislabs, Influxdata	NewSQL Databases SAP, Clustrix, Pivotal, paradigm4, nuOOD, memsql, splice, MariaDB, YOLTD, citusDATA, doopdb, Trafalgar, Cockroach LABS	BI Platforms Power BI, amazon, Domo, Wave Analytics, GoodData, birst, platform, atscale, SAP	Statistical Computing sas, SPSS, MATLAB	Log Analytics splunk, sumologic, kibana, cloud PHYSICS, loggly	Social Analytics Hootsuite, NETBASE, 3DATASIFT, track, bitty, synthosia, simple reach	Ad Optimization AppNexus, MediaMath, critico, rocketfuel, OpenX, theTradeDesk, Algorithms, distillery, Liventent, TAPAD, DataXu, Appier, MOAT	Security CYLANCE, CounterTrack, cyberason, AREA1 SECURITY, TimeOne, Recorded Future, FortScale, Keybase, feedzai, siftscience	Vertical AI Applications facebook, Clara, KASIST, lumiata			
Graph Databases neo4j, ORIENTDB, InfinitGraph	MPP Databases TERADATA, VERTICA, Netezza, Celonis, Kognitio, HADOOP, Dremio	Cloud EDW amazon, Microsoft Azure, Pivotal, snowflake, MATELINE, Infosworks	Data Transformation alteryx, talend, TRIFACTA, tamr, StreamSets, Alation	Data Integration informatica, MuleSoft, snoplogic, BedrockData, xplenty	Real-Time amazon, METAMARKETS, stream, confluent, DATAFORNADO, dataArtisans	Machine Learning Asie, H2O, SKYTREE, Dato, apliq, DATAFORNADO, YISENZE, PredictionIO, glowfish	Speech & NLP NarrativeScience, Cortana, sentiment, VIV, ARRIA, nora, Numenta, clarifai, MetaMind, IDIBON, YECOP, MetaMind	Horizontal AI IBM Watson, sentient, VIV, nora, Numenta, clarifai, MetaMind, IDIBON, YECOP, MetaMind	Publisher Tools outbrain, Taboola, quantcast, Chartbeat, yieldbot, Yieldmo	Govt / Regulation Socrata, OPENGOV, FiscalNote, enigma, PREPOP, mark43, OpenDataSoft	Finance affirm, LendingClub, OnDeck, Kreditech, finance, Lendip, Kabbage, tidemark, INSIKT, Chartbeat, Dataminr, Lenddo, KENSHC, AIDYIA, ISENTIUM, Quantopian, sentient
Management / Monitoring New Relic, AFFDYNAMICS, amazon, octifio, Numerify, splunk, DATADOG, DRIVEN, Anodot	Security TANIUM, illumio, CODE42, DataGravity, nimblestorage, VECTRA, BlueTron	Storage amazon, Microsoft Azure, panasas, CASK, Typesafe, COHO, Qumulo	App Dev apigee, CASK, Typesafe, DRIVEN	Web / Mobile crowd-sourcing, amazon, WorkFusion	Search elastic, ThoughtSpot, MAANA, swiftype, Algolia, SINEQUA, dataKind	Data Services UC OPERA, Mu Sigma, EXL, XEL, CLEARSTORY, CIRRO, import	For Business Analysts OrigamiLogic, ClearStory, CIRRO, import	Web / Mobile / Commerce Google Analytics, mixpanel, R.J.Metrics, BLUECORE, AMPUTITUDE, granify, sumal, retention, custora	Education / Learning KNEWTON, Clever, eleara, PANORAMA, knowte	Life Sciences 23andMe, Counsyl, Recombine, KYRUS, FLATIRON, zymergen, HealthTop, METABIOTA, ZEPHYR, OVI, Gingerio, transcriptic, Glow, Panoram, AICure, Atomix	Industries OPower, eHarmony, RetailNext, STITCH FIX, WorkFusion, BLUE RIVER, TACHYON, Seeq, FarmLogs, SwiftKey, HowGood, select, statmuse, BEXVER
Cross-Infrastructure/Analytics amazon, Google, Microsoft, IBM, SAP, SAS, HADOOP, HP, VERTICA, vmware, TIBCO, TERADATA, ORACLE, NetApp											
Framework HADOOP, YARN, Spark, MESOS, TEZ, Flink, CDAP	Query / Data Flow SLAMDATA, ANVIO, DRILL, Google Cloud Dataflow	Data Access cassandra, HBASE, mongoDB, COUCHDB, riak, CEMENTDB, nifi	Coordination talend, Apache Zookeeper, Apache Ambari	Real-Time STORM, Spark, APT, Flink, TACHYON, druid	Stat Tools ScalaLab, SciPy	Machine Learning mllib, Aerosolve, Caffe, WEKA, DIMSUM, TensorFlow	Search elasticsearch, Solr	Security Apache Ranger, Visualisation, Zeppelin			
Data Sources & APIs											
Health Apple, JAWBONE, GARMIN, practicefusion, fitbit, Withings, VALIDIC, netatmo, kinvo	IOT UPTAKE, ThingWorx, helium, samsara	Financial & Economic Data Bloomberg, DOW JONES, THOMSON REUTERS, DLEE, PREMISE, quandl, xignite, CBNSIGHTS, mattermark, StockTwits, estimate, PLAID	Air / Space / Sea PLANET, spire, AIRLUIS, SKYCATCH, Airware, DroneDeploy	Location / People / Entities axiomatic, Experian, GARMIN, foursquare, CRIMSON Hexagon, CARTODB, placemeter, BASIS	Other qualtrics, panjiva, DATA.GOV	Incubators & Schools GA, PLURALSIGHT, DataCamp, DataElite, The Data Incubator, METIS					



History



- In the 90s you had SCADA (PLC/PID)
- M2M era of Machine to Machine
- new devices, like wearables (fit bit)

Challenges

- Inter operability
- Simplistic
- Scale
- Roadmap
- Closed-system
- Limited eco-systems





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Pre Standardisation

- Innovation or early projects
- Experimentation
- Niche market starts to develop (AI/robots etc..)
- Small players get investment by larger players
- Echo systems start to develop in silos
- Areas of research and need for new new solutions increases
- Objectify the solutions into smaller blocks
- Need for standards takes birth
- Collaboration in industry as players recognise the need





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Benefits of Open Standards

- Open Standards lower total costs (TOC) and increase returns on investment (ROI) by providing the following benefits:

Interoperability

Vendor neutrality

Efficient use of existing resources

Greater use of automation

Flexibility

More options provide more opportunities to optimise

Lower and manageable risk

Robustness and durability

Quality

Increase available skills

Better human communication

Open Collaboration

Lower barriers to entry

Promote innovation



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During Standardisation period

- We are currently in this period
- Manufacturers join to form groups
 - Direct competitors (horizontal and vertical)
- Groups are formed for special/specific areas
- collaboration
- Standards organisations set up working groups



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Post standardisation

- Never stops, goes in to a cycle
- Echo system develops
- Technology is enhanced
- Research continues, prices fall
- Tipping point of a new era and we go into the unknown again





Standards Bodies and initiatives

- Allseen Alliance
 - AllJoyn
- IETF -
 - IPv6 and 6LoWPAN
 - Web of things (REST for IoT, CoAP, Resource Directory etc..)
 - CBOR - RFC 7409 / CoRE
 - Security (DTLS, TLS, Cipher suites) / Resource Directory
- Oasis - MQTT MQ Telemetry Transport
- OMG - Object Management Group
 - DDS - Data Distribution Services
- Companies
 - GE / Google / Apple
 - Open Interconnect Consortium (OIC)



I E T F[®]



AllJoyn[™]





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OMA Alliance

- Open Mobile Alliance - world's leading mobile operators
- non-profit organization
- new work leading next generation mobile services
- consolidation of standards activity within mobile industry
- OMA lightweight device management (based on CoAP)





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IPSO

- IPSO - a global forum comprising a diverse international membership focused on enabling IoT devices to communicate
- enable IoT device interoperability through semantics
- specify and publish models
- Semantics - Smart Object Definition
- IPSO Web Objects

IPSO reuses OMA standard. Defines device-server interface

- Bootstrapping
- Registrations
- object/Resource access
- Reporting
- (whole device management)



IPSO (2)

Stack

- Efficient payload
- CoAP protocol
- DTLS security
- UDP or SMS Bearer

Function Set	Root Path	Resource Type
Device	/dev	ipso.dev
General Purpose IO	/gpio	ipso.gpio
Power	/pwr	ipso.pwr
Load Control	/load	ipso.load
Sensors	/sen	ipso.sen
Light Control	/lt	ipso.lt
Message	/msg	ipso.msg
Location	/loc	ipso.loc
Configuration	/cfg	ipso.cfg

Device management use objects (DM objects) similar in **OMA LW**

- Collection of very small binary REST objects
- URIs under a base path (similar to SNMP paths)
- E.g temp object_ID=311 so /311 get you temp
- Then under there you define resources /2 = temperature value
/3=max temp /4=min temp



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Zigbee

- Zigbee IP - An open standard 6LoWPAN competitor for Home Area Networks
- Sigbee IP NAN - 6LoWPAN stack for Sub-GHz large area applications
- Been around for much longer
- Gives more batter life, due to spending more time in sleep mode
- Mature technology
- Can't communicate with other protocols like 6LoWPAN



OneM2m

- develop technical specifications which address the need for a common M2M Service Layer
- provide a framework to support a wide range of applications and services
 - Smart cities
 - Smart grid
 - Connected car
 - Home automation
 - Public safety
 - Health
- a three layer model





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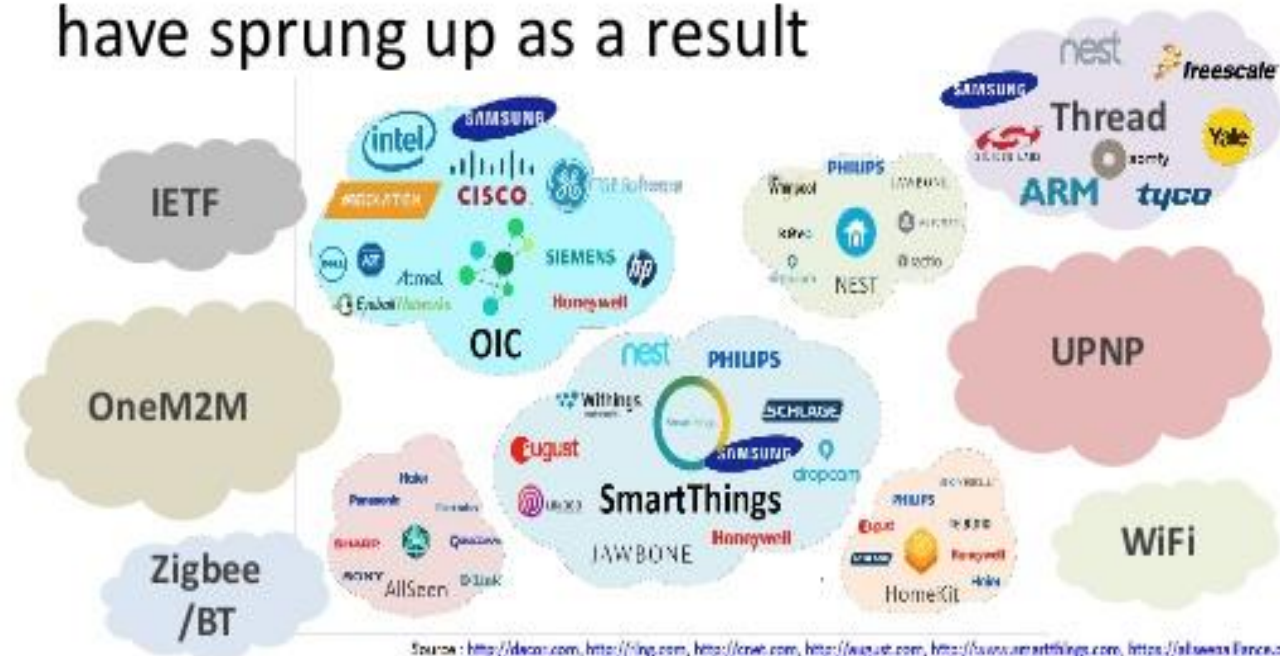
Handbook: Internet of Things Alliances and Consortia

Technology Architecture Focused						Marketing / Education
Link / Comms						
Core / Session / Transport / Messaging / Semantic						
Multilayer						
Vertical Focused						
Protocol						
Industry						



IoT Standards Ecosystem

- Plenty of Groups and De Facto Standards have sprung up as a result





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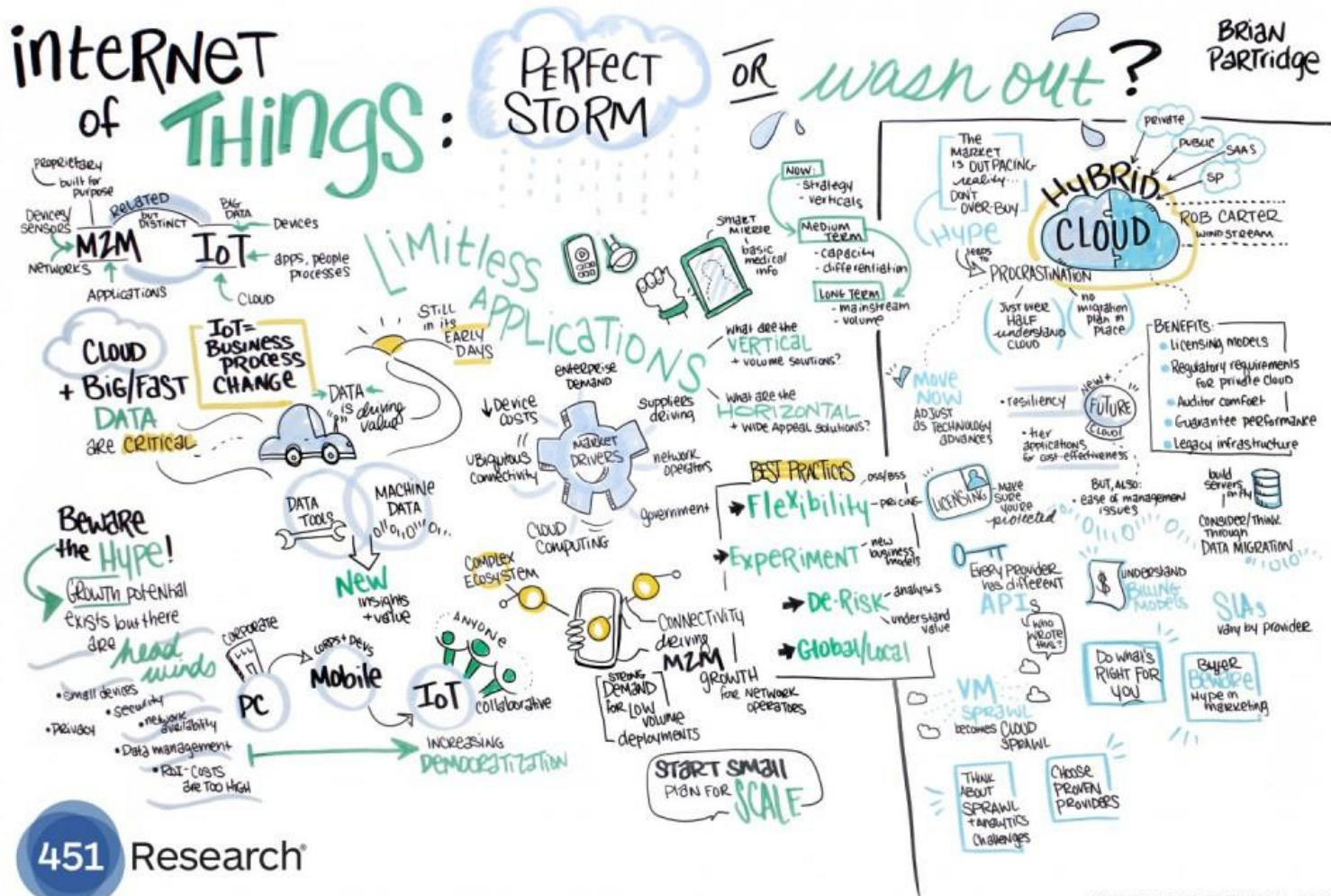
Standards in the Region

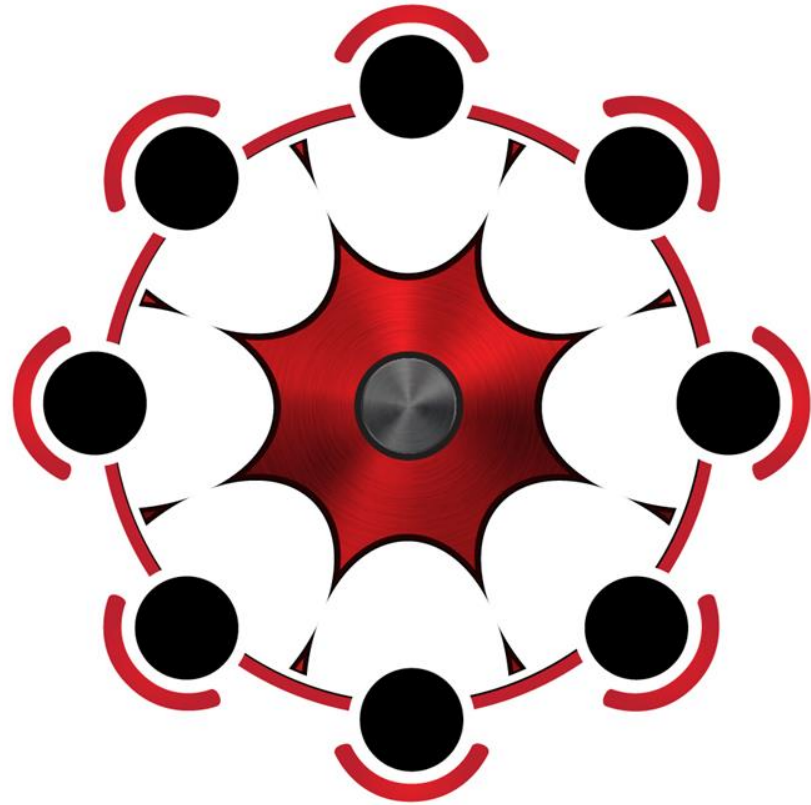
- Regulators Standards vs Industry Standards
 - FinTEC : Banking, e-money (cryptocurrency)
 - InsurTEC / LegalTEC / HealthTEC
- Spectrum/wireless
 - CDMA/GSM
 - LTE (APAC vs NAR vs EUMA)
 - Broadcast TV (ISDB vs DVB-T vs ATSC)



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