Challanges of IoT

Internet of Things

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- The second form of connectivity is in terms of service connectivity. Even if packets from a physical device can reach the backend, it needs to be appropriately registered so that the backend can deliver these messages to the appropriate services.
- Any kind of changes to the availability of the services has to be notified to the respective devices. Otherwise devices will unknowingly flood requests to an unavailable server leading to DOS attacks.

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- In most IoT applications it is sufficient to verify just the field devices, but in a few sensitive situations it might require two way verification of the backend system as well.
- An adversary node might inject some malicious data in a roaming network before moving back to the home network and hide itself in the roaming network to promote repudiation attacks. Further a cloned node may illegally want to exploit the mobility to co-exist in another network

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- Alternatively in the case of vertical scalability, the network can extend multiple hops. It is thus important to be able to trust intermediate nodes in the field area network. Otherwise, it has the potential to introduce sinkhole or wormhole attacks.

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- For further security, there should be a global repository where device-IP mappings can be queried for authenticity by interested services or certificate providers.

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- Also to ensure the time drifts within the FAN cannot be exploited for replay attacks, the APIs exposed by the backend system should ideally be idempotent.
- Additionally the backend system must take into account the variance in the location data that is available from the end nodes. Otherwise it results in an inaccuracy of fault reporting leading to incorrect decisions.

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- As these nodes are open in the environment and easily accessible physically, they can be cloned and tampered.
- Also as these nodes have very little computation and storage capabilities, they preferably upload the data into the cloud for huge computations and storage. For this reason the user data privacy issues also creep in. So strong cryptographic encryption and integrity mechanisms need to be applied.

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- If an encrypted packet is decrypted and repacked at multiple points in the communication chain, it opens up a security vulnerability including information leakage and user privacy because the keys are being shared between multiple devices.
- Moreover, as the intermediary nodes are involved in crypto works they in turn become prone towards resource exhaustion and DOS attacks. For this reason end to end encryptions are better preferred.

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- As the IoT architecture is hugely distributed, the user data becomes distributed in the clouds. So without proper security measures it may lead to information leakage and user privacy issues. Accounting information inconsistencies may also arise here unless correct measures have been taken.

Security Challenges in IOT

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- In the extreme case, the node may be needed to flush all data remotely so that the critical data are by no means accessed by illegal malicious nodes. Cloning of nodes can be prevented by allowing no access to its memory or crypto information from external sources.

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- At the end, detailed accounting information of the transaction should be logged. This way it will prevent to get exploited from spoofing, repudiation and privilege elevation attacks.

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- Since the nodes have very less memory they can't store huge amounts of data or are capable of doing huge computations and thus off-load them to powerful cloud servers.
- Stored data should be properly signed and encrypted so that they are genuine data and not readable by an anonymous entity.

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- Highly trust based systems are to work in these middle nodes and proxies.

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- Also the affected nodes should be isolated and investigated for the security breach.

Multi layer security

Higher layer protocols like (D)TLS, IpSec, etc. provide E2E security. But low powered devices latching with the gateway might run on 6LoWPAN and they in their network might need to adapt 802.15.4 link layer security. So the protocol stack should be flexible and accustomed with multiple security solutions while still maintaining the normal security requirements.

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- The loss due to spoofing can be limited by reducing the trust relationships, deep packet inspection and use anti-spoofing techniques.
- Parties involved n MITM attacks should be guarded by using certificate authentications wherever possible and message integrity checks using MAC and MIC should be used.

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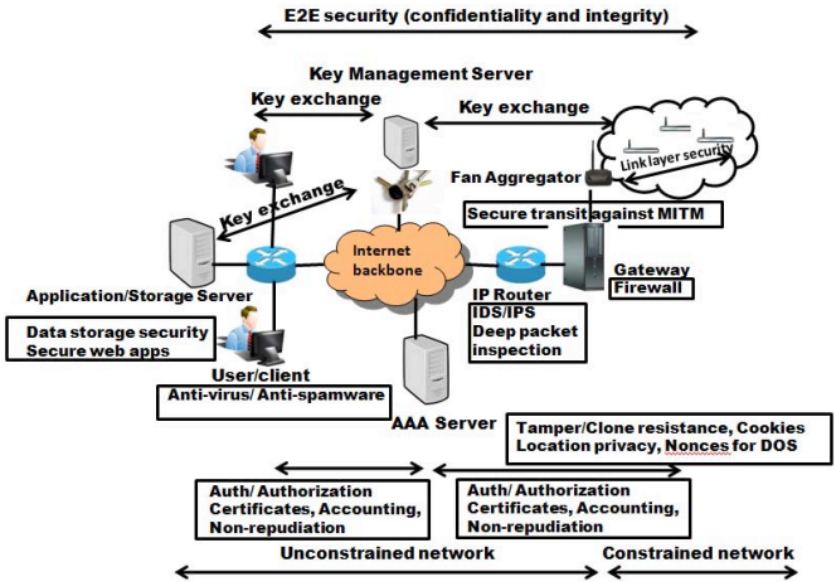
- Encryption, authentication, integrity, anti-replay, non-repudiation which stands as the basic mechanisms for security needs to be applied correspondingly but in a light-weight fashion to protect against the attacks.


E2E security (confidentiality and integrity)
Key Management Server
Key exchange
Key exchange
Key exchange
Link layer security
Fan Aggregator
Secure transit against MITM
Internet backbone
Gateway
Firewall
IP Router
IDS/IPS
Deep packet inspection
Application/Storage Server
Data storage security
Secure web apps
User/client
Anti-virus/ Anti-spamware
AAA Server
Tamper/Clone resistance, Cookies
Location privacy, Nonces for DOS
Auth/ Authorization
Certificates, Accounting,
Non-repudiation
Auth/ Authorization
Certificates, Accounting,
Non-repudiation
Unconstrained network
Constrained network

Other Challanges

Global cooperation

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- An opportunity investment approach in the US that is driven by short to mid-term return on investment. It is pushed by smart energy, smart cities, and RFID fueled by Department of Defense and Wal-Mart.

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- It may be the case that IoT will favor a situation where different forms of currencies, standards of banking and money will exist together

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- Privacy is a key challenge that people may have about living in a future connected environment
- Privacy Enhancing Technologies (PET) is a partial solution. The Privacy Coach, produced by a small Dutch consortium of RFID experts, is an application running on a mobile phone that supports customers in making privacy decisions when confronted with RFID tags

Finding the perfect balance between top down planning and bottom up innovation

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- IoT could be extremely relevant in making direct feedback visible in street and city furniture, and mobile applications.
- The internet of things can be a layer of data, open to all, through which individuals can decide for themselves what they are willing to pay for, get direct feedback from their voluntary donations, coordinate community spending that has a direct bearing to their needs through participatory budgeting