Ubiquitous Networking: from Interoperability testing to Connectivity testing. Andrey Kucheryavy(SG11 WP4 Chairmen, Giprosvyaz, Russia).

ITU Forum on Conformance and Interoperability Testing in CIS and EUR Regions

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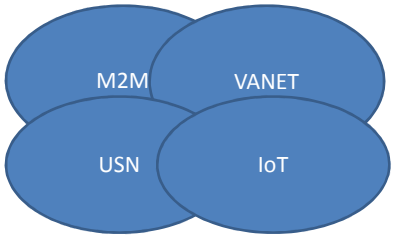
Network Development Forecast

7 trillion wireless devices for
7 billion people up to
2017 – 2020 years
(Wireless World Research Forum, 2009)

Network Development Concepts

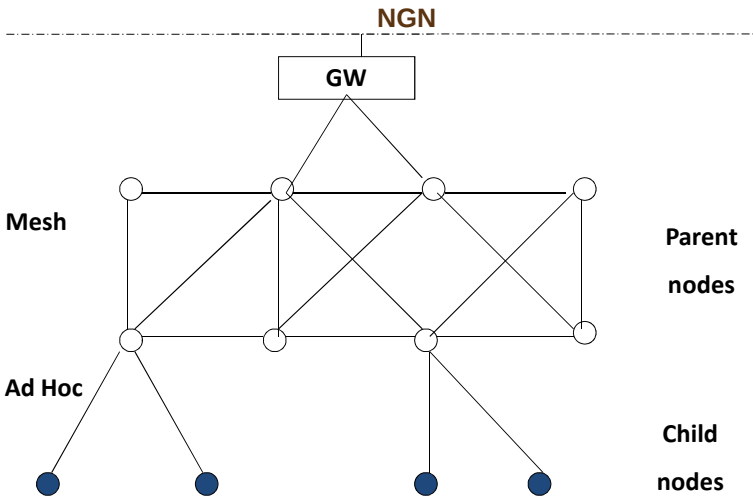


IoT – Internet of Things
USN – Ubiquitous sensor Networks
VANET – Vehicular Ad Hoc Network
M2M – Machine – to - Machine

Self-organizing Network Determination

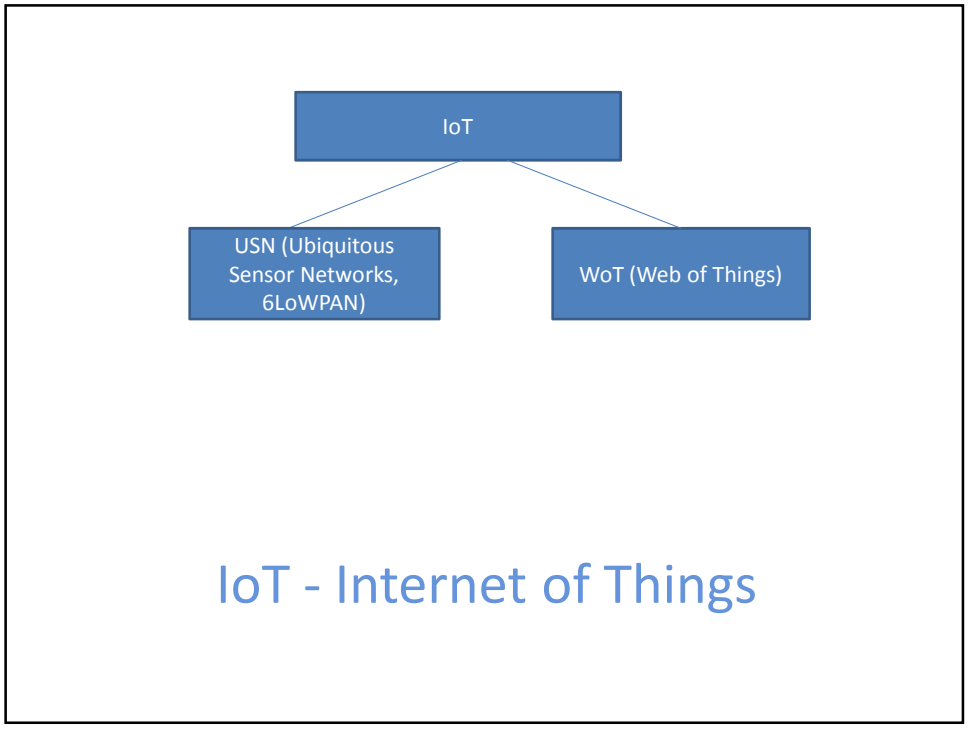
- The self-organizing network is a network with the random number of nodes in any time of operation. The number of network nodes could be change from 0 up to Nmax.
- The lines between network nodes in the self-organizing network are temporary created for any goal achievement or for the information sending to NGN, Internet and so on.

Self-organizing network architecture

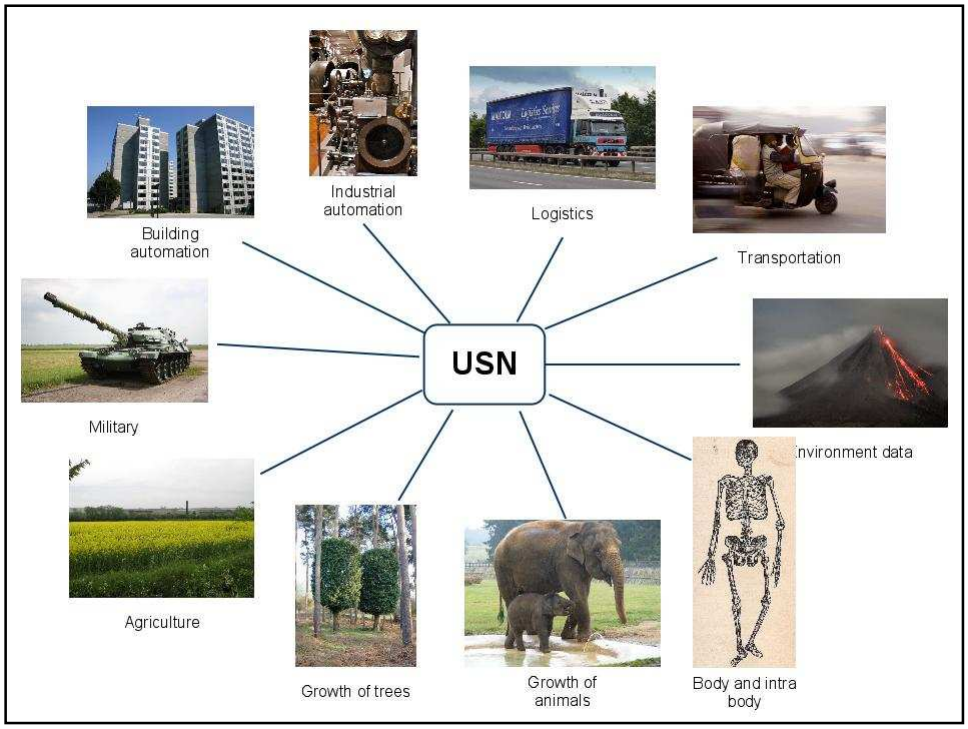


Application examples

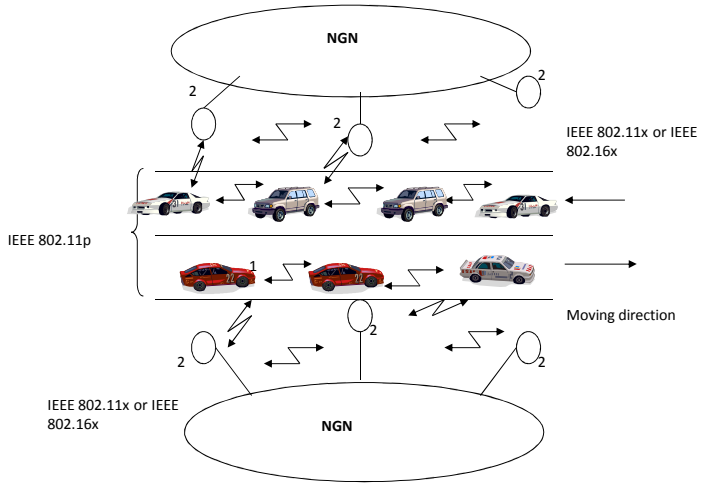
1. USN – Ubiquitous Sensor Network.
2. VANET – Vehicular Ad Hoc Network.
3. HANET – Home Ad hoc Network.
4. MBAN(S) – Medicine Body Area Network (services)



IoT - Internet of Things



VANET (Vehicular Ad Hoc Network)



1 – cars
2 – roadside network nodes

Recommendation Y.2281

- V2V – Vehicular to Vehicular
- V2I – Vehicular to Infrastructure
- V2H – Vehicular to Home
- V2G – Vehicular to Grid

Networked vehicle applications

1.Vehicle maintenance-oriented services/applications (SA-1):

- Remote vehicle diagnosis,
- Vehicle data/software provisioning and update;

2. **Road safety services/applications (SA-2)**:

- Driving assistance – Co-operative awareness,
- Driving assistance – Road Hazard Warningподдержка;

3. **Passenger-oriented services/applications (SA-3)**:

- interpersonal conversational services,
- audiovisual services (e.g., IPTV services),
- informational services (e.g., about the presence of locally based services or/and points of interest),
- access to Internet;

4. **Traffic efficiency services/applications (SA-4)**:

- Speed management covering use cases such as 'Regulatory/contextual speed limits' and 'Traffic light optimal speed advisory',
- Co-operative navigation covering use cases such as 'Traffic information and recommended itinerary', 'Enhanced route guidance and navigation' and 'Limited access warning and detour notification' ;

5. Vehicle-oriented services/applications (SA-5):

- fleet management ,
- vehicle parking management applications.

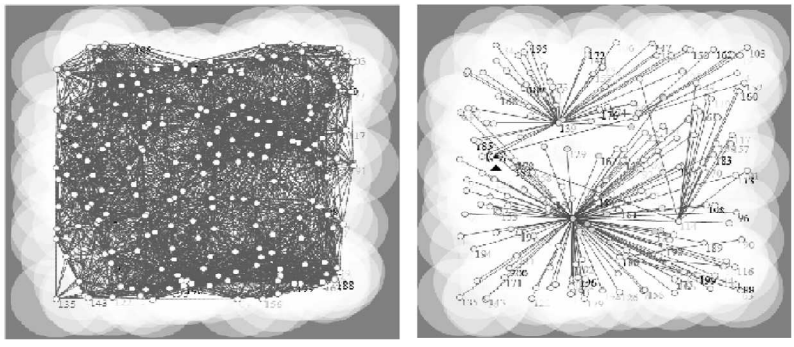
Interoperability for Self-organizing Network

- The interoperability network problem is absent for self-organizing networks. The self-testing at the beginning of the network life-time makes the interoperability guaranteed. The interoperability testing is not needed in self-organizing networks conditions in full.

New Parameters for Self-organizing Network

- The two very important parameters for self-organizing networks are connectivity and life-time. The connectivity and life-time parameters depend strongly on the using algorithms self-organizing network.

C#.NET



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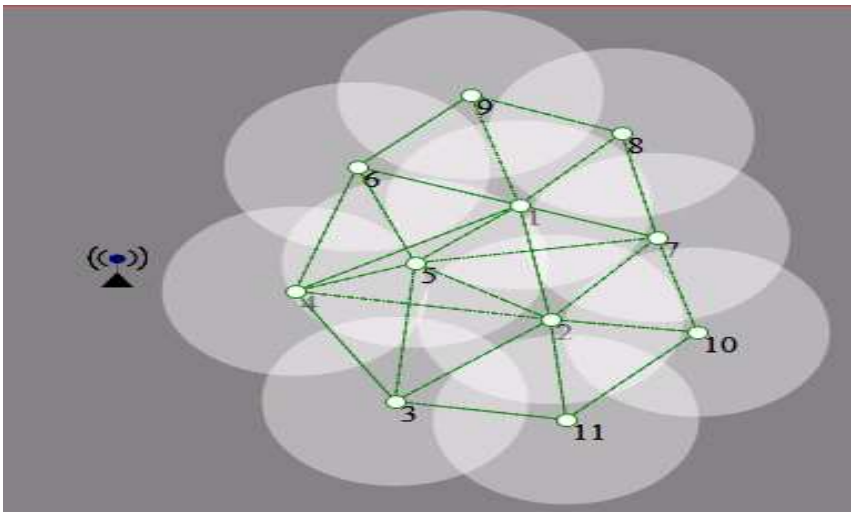
Connectivity



Algorithm LEACH-M

- LEACH-M (Low Energy Adaptive Clustering Hierarchy for Mobile Sensor Networks)
- Criterion: energy.

Algorithm DCA

- DCA (Distributed Clustering Algorithm for Mobile Sensor Network)
- Criteria:

  connectivity,

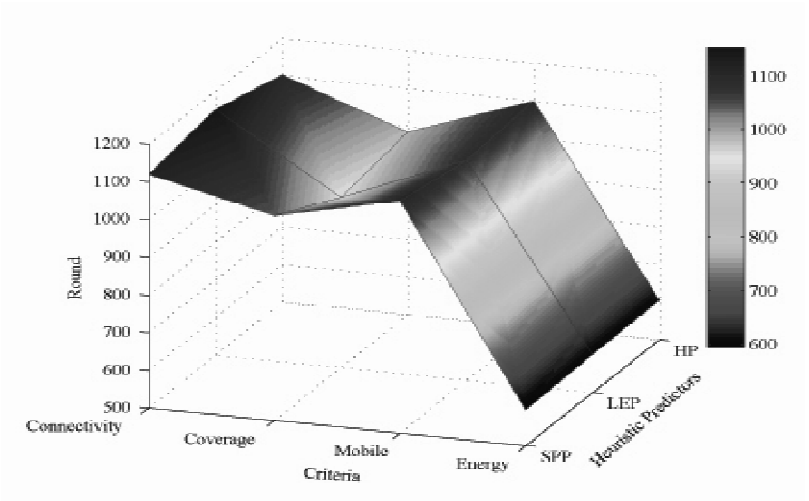
  coverage,

  mobile,

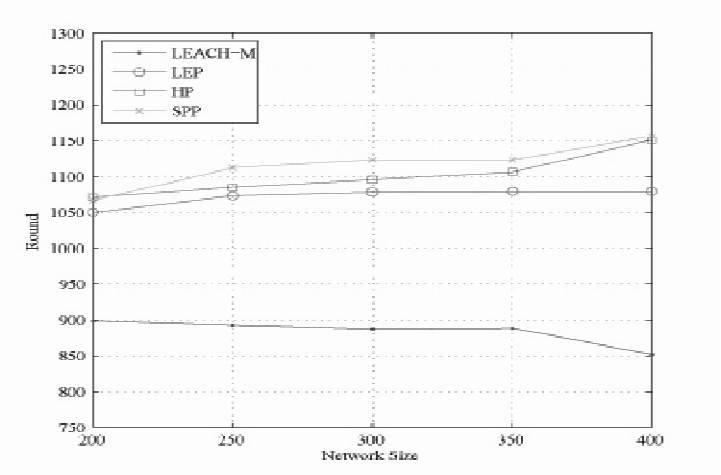
  energy.

Prediction-based DCA

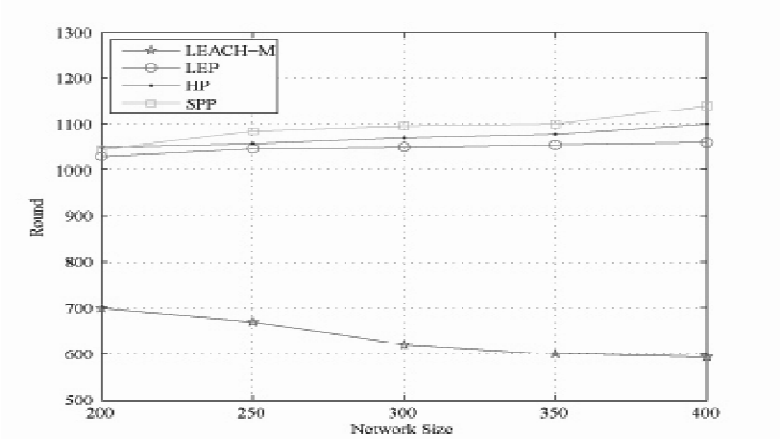
- **Hybrid Predictor (HP)**
- **Linear Extrapolation Predictor (LEP)**
- **Hybrid Predictor (HP)**



Network life-time using DCA vs. LEACH-M when the sink locates at the center of network.



Network life-time using DCA vs. LEACH-M when the sink locates outside the network.



Conclusions.

1. The self-organizing networks will be most important network structure in the nearest future.
2. The interoperability network problem is absent for self-organizing networks.
3. The most important parameters for self-organizing networks are connectivity and life-time.

Conclusions (2)

4. The connectivity is the more strong parameter than coverage, mobile and energy for mobile sensor network life-time.