D-MESH TECHNOLOGY COMPANY DJV-COM: CONNECTION ALWAYS AND EVERYWHERE
(20 QUESTIONS)

D-Mesh - a multi-node wireless (mesh) networks with low data rates and ultra low power system for data collection and transmission of control commands. D-Mesh networks have many practical advantages compared to wired systems: no need to run cables for power and data transmission, low cost of installation, commissioning and maintenance of the system and the possibility of introducing modifications to the network operated by the facility without interfering with the process of operation; reliability and resiliency of the system as a whole with the violation of individual connections between nodes, the total self-organization, scalable, work in real-time, time-tested software and hardware.

1. The degree of readiness. Is D-Mesh ready to use in practice technology?

Yes, DJV-COM has already been installed several thousand points of consideration in gas consumption and heat, consisting of networks of 50-270 nodes. Work on optimizing the price and functionality continue.

2. Cost. How is the total price of the sensor network?

The cost of wireless sensor network consist of the cost of design, equipment, commissioning and subsequent maintenance of the system. Typically, the cost of radios is a small part of total system cost. At full price may include the cost of managing the processor, housing, connectors, batteries, as well as repeaters, routers, power modules, the cost of pre-testing, research radio coverage, the definition of installation sites repeaters, routers, which requires both special equipment and appropriate skills .

If there are routers with constant power, must take into account the cost of laying the power supply and installation of a vandal housing. Availability of equipment requiring power-liner, as well as mounting blocks on the walls and pillars significantly increases the price and brings us closer to the cost of installing wired equipment.

For example, experts of the company Tendril lead following types of distribution costs: equipment 10%; base software 10-15%, installation 10-20%, troubleshooting and maintenance of 5-10%; system and application software 50-65% (1*,2*).

Paying for radio is 10-20$, you may need to pay another 90 - 180 $ on the point, to obtain data on your computer.

Price cost point of sensor networks D-Mech does not depend on the complexity of the network architecture, the number of nodes in the network, the frequency of changing the structure of the network, as well as features, user interface software. To deploy the network does not require special education and training, as well as special equipment and design work. The cost of batteries is minimal, and the time of service at least 6 years.

3. Time. What it takes time to deploy the sensor network?

Wireless sensor networks can greatly reduce assembly time compared to wired data collection systems.

DJV-COM offers a self-organizing networks with hot-swappable network elements. To install a network node is required from 3 to 4 minutes. Without prior planning, without the preparatory work, without special equipment and expertise. Integration and network configuration is not required. Ongoing monitoring and maintenance is not required. To use custom applications sufficiently recorded in the database match the ID node physical location of installation.

4. Scalability. As the number of nodes affects the cost and complexity of the sensor network?

Scalability is one of the key properties of data transmission systems. Sensor networks have a bad reputation with the number of points 10-15. In contrast, the network DJV-COM work with the number of points on the network 1000 and more. The number of collisions does not increase.

Network Protocols D-Mesh are constructed in such a way that does not allow the discharge of batteries with an increase in the number of devices in the network and increasing the amount of information transmitted through them.

In most systems, price increases linearly, while the complexity exponentially on the number of devices in the network. For D-Mesh networks complexity does not increase with the number of points in the network, and the price the cost per point decreases as the cost of network coordinator is distributed to a larger number of devices.

For D-Mesh networks resolved the question of reliable networks with overlapping audibility, which allows you to set on the same site for up to 4 subnets, which increases the possibility of scalable networks D-Mesh.

5. Network Management.

Software D-Mesh network provides diagnostics, automatic reports delivery of data, information on the status of the network and accidents. The network does not require management, the network itself is configured by a permutation, add or remove a node.

6. Problems. Who is usually responsible for problems after installing the sensor network D-Mesh?

Access for remote monitoring. It is possible to access the database on the Internet and analysis of log exchange with the coordinators of the network. Available information on network status and battery status on the target device. Your hardware manufacturer provides technical support.

7. Interfaces. How data is presented to the end user?

For the modern user data, even if they are analog, should be provided on a personal computer: for example, locally via a USB interface, or remotely via the Internet or web-page, or export to EXEL format in the form of tables and graphs for data and accidents. Access is possible both to current data, and to archive data for the selected date, that allows the user to optimize energy consumption.

8. Integration. How to integrate these sensors with existing databases?

Web - interfaces, IP-Network, the export to SQL databases, and open interfaces of data exchange have become de facto standards for today's business systems, which are suitable both for the exchange of financial information and information from the sensors.

9. Is there a difference between temporary and permanent installation network?
No difference. If the pilot project established a number of devices to ensure system uptime, you can easily install the necessary number of additional devices. For the demo version, if the frequency of activity on the network is much more labor, time of battery life may be less.

10. ROI. What are the best ways to measure return-on-investment for a sensor network?

For each application has its own methods of calculation: it's saves time for the collection of information, is's the reliability and timeliness of information obtained, it's an opportunity to respond to the situation in real time, the balance control on the specified objects in the case of energy consumption, it's timely response to the accident, which enables maintain expensive equipment or to prevent the leakage of energy resource - gas, water, heat energy. This control of the consumer - the ability to manage executive mechanisms, it's forecast consumption for a given site on the basis of an analysis of consumption for the previous month / season / year, it's control the leakage of gas and water - the safety of consumer and resource savings.

11. Resources. What level of education needed for the deployment of sensor networks?

To deploy a sensor network D-Mesh do not need special education. Anyone will be able to install radio modules and any user of the computer - run the system. The system operates on the principle of «plug & play». Run the system is no more difficult than running a personal computer.

12. As sensor network D-Mesh installed and activated?
Insert the battery, connect sensors, install nodes, plug into the mains network coordinator of the network, into a table match the physical address (the subscriber) unique identification number of the module. Further elements of self-organizing network identify each other, build a data network and data received on the server.

13. Communication range.
Must be remembered that the range of 2.4 GHz devices will not work in the rain and will not work in a metal box.

We propose to use more low-frequency ranges of ISM bands. They preferred to use, because the less loaded, and radio waves of this range is less absorbed by walls.

Typical values range form 20-40 m indoors and 200-400 meters in open space in the line of sight. However, the ability of nodes to relay messages to each other and automatically search for routes packet to bypass the obstacles makes it possible to use D-Mesh networks in harsh conditions. The result is a large area of coverage for low-power transmitters and significant energy savings.

For networks D-Mesh distance is limited only by limiting the number of levels in the relay network. For example, if the number of levels is limited to 30, into the buildings can be expected to cover 300-600 m, and the field radius of the network coverage can reach 6-12 km.

14. Batteries. What you need to know about power consumption and battery life?

Battery life depends on a network node battery capacity and the average current consumption, which is determined by the period of communication, quality and number of retransmitted packets. Not everything on the market for wireless networking solutions allow you to create full-mesh-network, in which all nodes are able to perform the retransmission at work on the autonomous elements of nutrition.

Users should check with the supplier, if he claims long battery life, such as 5-10 years, for which conditions apply such a term. This applies to the allowable amount of data transferred per day, the number of devices in the network and whether the device is a router.

15. Data protection. What you need to know the user data protection in data transmission?

Usually protected data on the radio channel and user authentication for custom applications. Protecting data at the level of the radio channel - is carried out based on scrambling of data, interleaving, and jumps in frequency. Cryptographic protection of data is used when sufficient justification (see SP100 wireless standard).

16. Reliability.

On the reliability of the network affected by many factors, such as distance, type of power, topology, protocol, signal strength, interference and extraneous signals. The best way to determine the reliability of the product - installation of a pilot project.

D-Mesh network adapt to the conditions of the environment and provide greater reliability than wired communication systems, due to communication redundancy.

The first requirement is reliability - the use of a protocol with the frequency jumps to prevent fading and to avoid narrowband interference in the working range. The second requirement of reliability - the use of protocols self-organizing networks. Only this can guarantee the network performance under constantly changing environment. The third requirement of reliability - the device must have a self-diagnosis function and pass the flags of accidents in case of emergencies.

17. Infrastructure. How these networks transmitted data into the existing structure of the consumer?

Network coordinator is the link between the radio channel sensor networks and IP network. In this protocol radio network tunneled through the IP network. Custom applications will transform the received data in a convenient format for visualization and export to other applications or databases.

18. Hardware platform.

Common hardware platforms only produced. For example, ZegBee radio modules from different manufacturers do not guarantee the compatibility of the same network. When choosing a supplier of sensor networks need to pay attention to the extensibility and scalability of the platform.

Network Devices D-Mesh are able to update the software, both locally and over the air to meet the ever increasing demands of customers, as well as for compatibility with later versions.

19. Intelligence sensors.

Network nodes D-Mesh network makes for a series of calculations and decide on the reliability of incoming information, and produce diagnostic performance of individual units. This significantly reduces the demands on network bandwidth, increase scalability and lifetime of the system.

20. Standards. The problem of the existence of multiple technologies and protocols (based on 1 * and 2 *).

Today ZigBee is the only set the standard in wireless networks. At the same time, according to the expert company Sensicast – protocols based on ZegBee standards creates a large amount of data routing, which degrades network throughput and drastically reduces the battery life.

In June 2007, was approved by the 7 version of the standard HART, in which one of the most significant innovations is the specification WirelessHART, add wireless transmission of data in HART-system. A similar standard ISA SP100.11a is still in the process of development.

After the adoption of standards should take a long time before you get to the corresponding ready-made products and will acquire practical experience in their application. Of course, the use of standardized technology has many known advantages, the main of which - to ensure compatibility and interoperability between products from different manufacturers. If you are not supposed to create a network of devices from different manufacturers and / or require a closed system to ensure security, the specialized platform may be preferable. Moreover, sometimes it is impossible to create a system that meets the specific requirements of applications based on standards, while some specialized technology makes it possible to do it. It is obvious that there is no optimal solutions for all problems, so when choosing between standardized and customized solutions should first assess the extent to which the technical capabilities of products for the task.

Comparative characteristics of wireless data networks D-Mesh.

Parameters	D-Mesh
Topology network	Cluster tree
The number of devices supported by the network	To 1500 (of which 240 with the function of routing)
The volume of data transmitted on the network node / day	To 1500 packets
Operating Frequency	433 MHz (315, 868, 915, 2400 on request)
Radiation power	< 10 mW
PHY data rate	25 - 250 kBaud
The reliability of data	CRC16 + match data formats
Immunity of data	Frequency hopping
Type of transmission / modulation	Two-way communication / GFSK
The number of levels relay	Up to 30
Parameters of the input pulses	f max <= 1Hz, t imp. > = 500 ms
Transmission range: Inside the buildings, Line-of-sight	 20 – 40 m 200 – 400 m
Diameter of zone to be covered at an average distance of 70m	To 4200 meters
Data with a timestamp	Yes
High adaptability deployment / operation	Yes
The need to configure the devices / network	No
Additional installation / removal of individual devices	Yes
The network working when changing external factors	Yes
Possibility of local RF access	Yes
The efficiency due to overlapping networks of audibility	Yes (up to 16 networks)
Automatic routing	Yes
The cost of a single point of network	12 - 39 Euro (from the quantity of order)
Dimensions radiomodul with box	68 mm x 55 mm x 32 mm
Power supply / minimum life	lithium battery 2A * h / 6 years
Storing data in the absence of power	10 years
Data Buffer	60 days
Degree of protection	IP51
Operational temperature range radio module	from -20 'C to + 60 'C
Warranty period	24 months
Compliance	Certificate of the Republic of Moldova

For comparison with the capabilities of other wireless sensor networks suggest you review the following publications:

1* Wireless sensor networks: 20 Questions (en) http://www.specialtypub.com/pdfs/M2M_20questions.pdf
2* Wireless sensor networks: Questions and Answers (ru) Беспроводные сенсорные сети: вопросы и ответы