



# Russian Academy of Sciences Program Systems Institute

## Sensor network technology platform

### Project status

- R&D to be completed by 2008 Q4.
- Ready to the market by 2009 Q4.

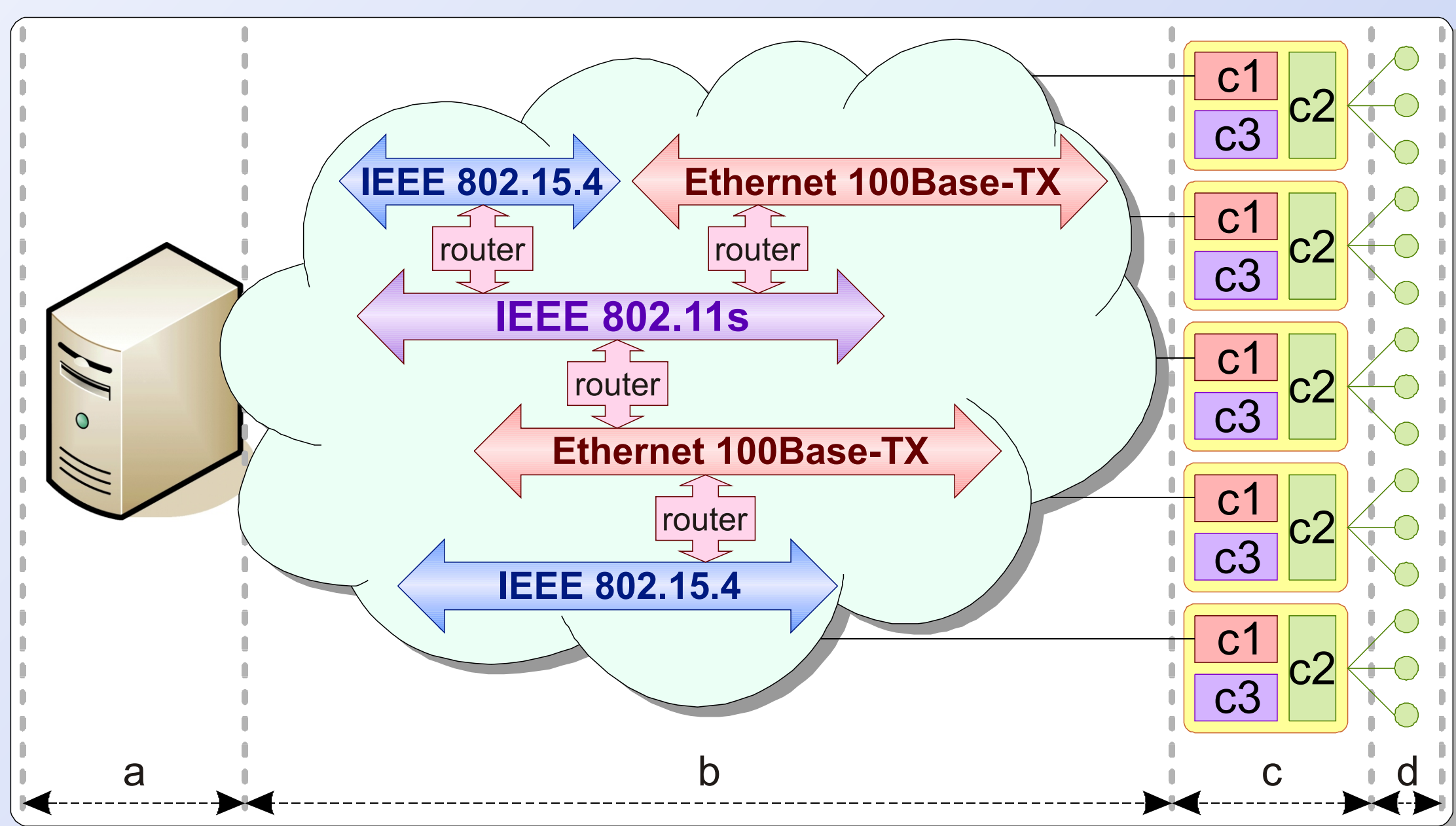
### General view of a sensor network

Generally, a sensor network consists of:

- server(s) performing data collection and control (a);
- data transfer network (b);
- sensor network nodes (c);
- sensors and actuators attached to the real-life object (d).

One popular approach to sensor networks uses off-the-shelf universal sensor node devices ("motes") featuring a network interface (typically a 2.4GHz radio) and a number of built-in sensors as well as sensor interfaces.

Another widespread approach is to develop new sensor node type for every new application.



### Real life hardships

The practical application of sensor networks encounters the following obstacles:

- the real life sensors and actuators are numerous (thousands) and not well standardized, a single inexpensive mote cannot support the diversity;
- no single network technology fits all applications well;
- no single power supply solution fits all applications well;
- many potential applications are not bulk enough to justify development of application-specific sensor node.

### How this project tries to cope

The solution proposed by this project is twofold:

- The data transfer network is built as an internetwork of different physical segments. Promising physical network candidates are Ethernet, IEEE 802.11s, and IEEE 802.15.4. Combining these technologies one can achieve the necessary combination of bandwidth, coverage, and cost.
- The sensor nodes are made modular, built from a set of inexpensive orthogonal modules:
  - one base module, providing interface to the data transfer network;
  - one or more peripheral modules, providing interfaces to sensors and actuators;
  - one power supply module which supply power to the sensor node using various power sources, from mains to batteries.

Using a small set of modules, one can create a broad diversity of sensor node configurations exactly fitting the application.

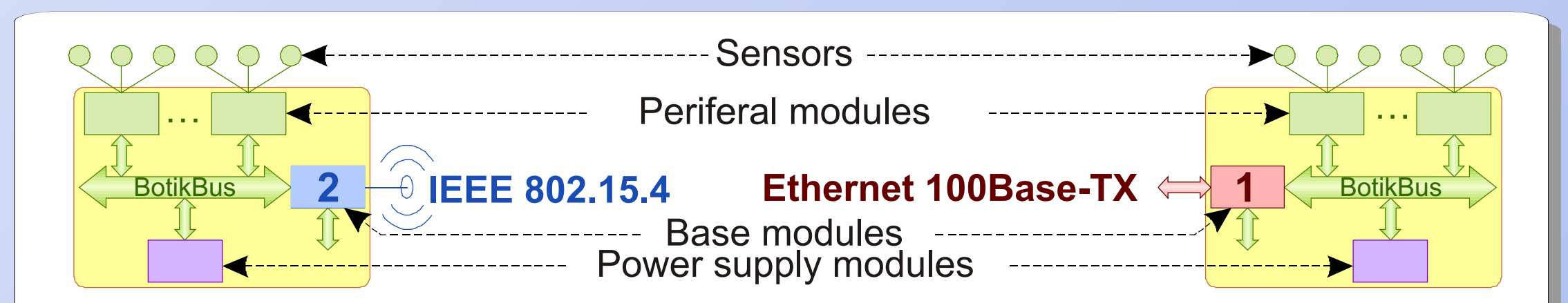
### What are the advantages?

- Virtually any sensor, actuator, physical data transfer network or power source can be supported at the cost of adding an appropriate module to the sensor node.
- New modules can be developed quickly because they are simple and most design solutions can be borrowed from the modules developed before.
- Application-specific sensor node construction can be left to the customer.
- The small set of modules is easier in production and storage.
- The customer spare parts list is smaller, too.
- Firmware and software can be unified and modular.

### The basic sensor network builder kit

Here is the list of modules currently under development:

- base module 1: Ethernet 100Base-TX, BotikBus, RS-485
- base module 2: IEEE 802.15.4, BotikBus, RS-485
- base module 3: IEEE 802.11s, Ethernet
- peripheral modules: BotikBus and one of RS-232, RS-485, RS-422, CAN, or other industrial interfaces
- power supply modules: AC220V to DC24V, DC48V to DC24V, SLA, alkaline AA.

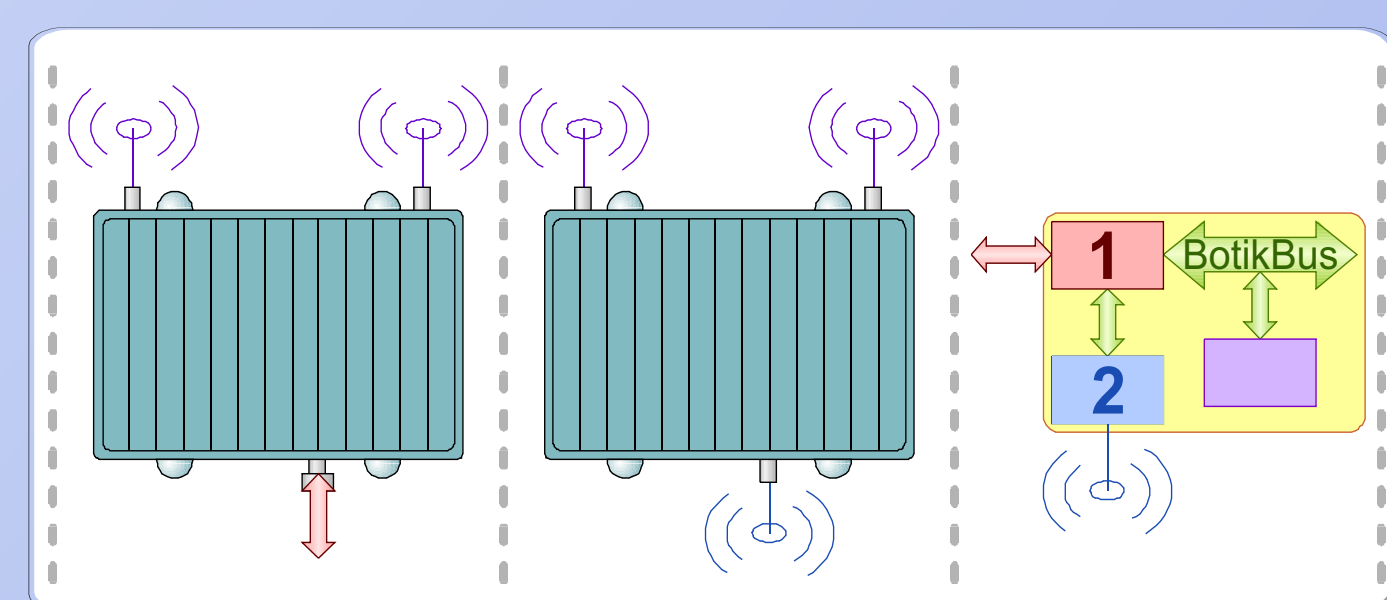


### Router nodes

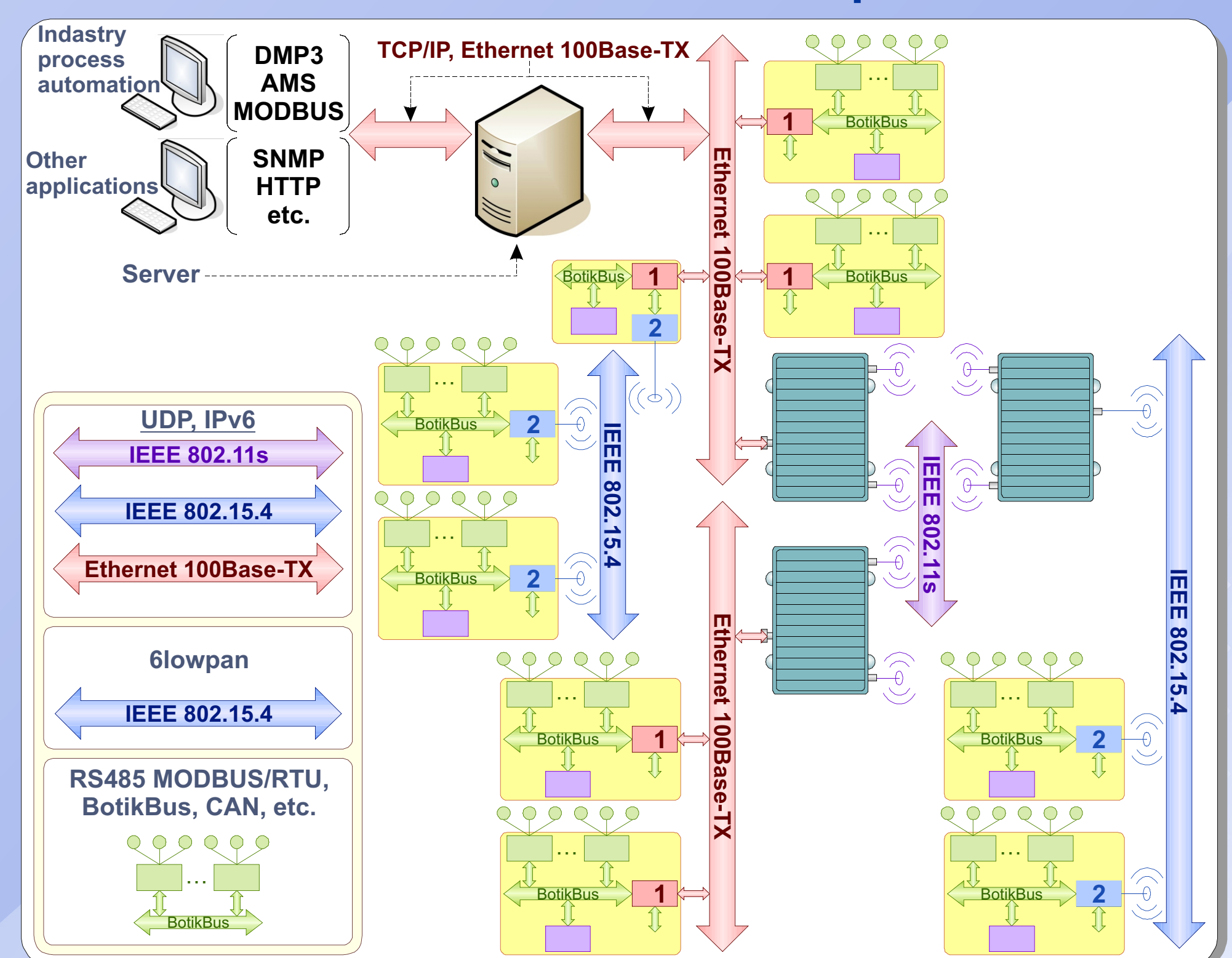
Router nodes connect different physical network segment to form a single data transfer internetwork. Like the regular sensor nodes, router nodes are modular. Unlike the regular sensor nodes, router node contains not one base module but two of them with different physical network interfaces.

Examples of useful router nodes are:

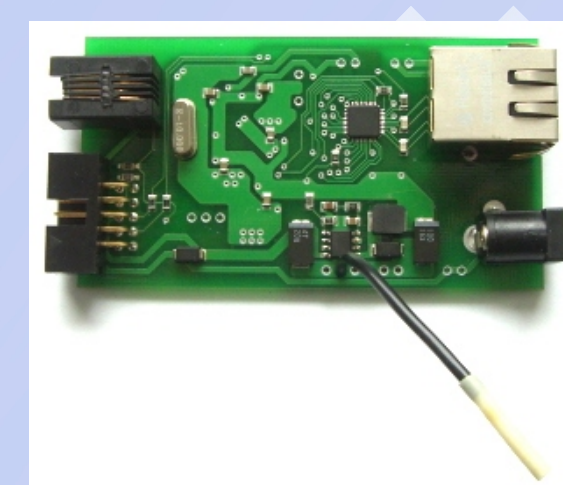
- Ethernet 100Base-TX to IEEE 802.11s
- Ethernet 100Base-TX to IEEE 802.15.4
- IEEE 802.11s to IEEE 802.15.4



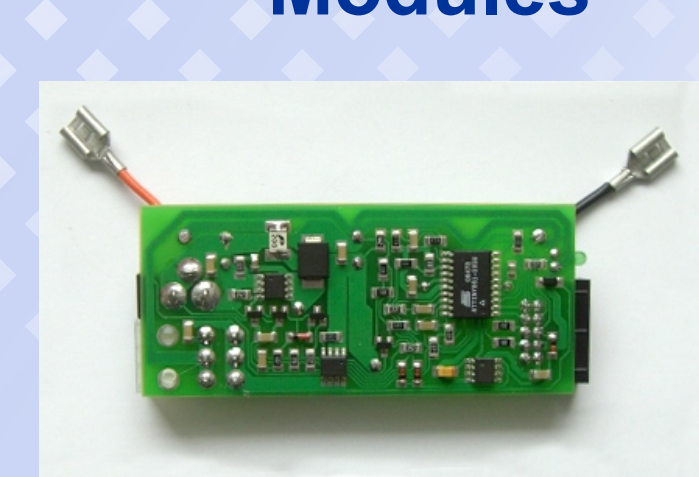
### Sensor Network Example



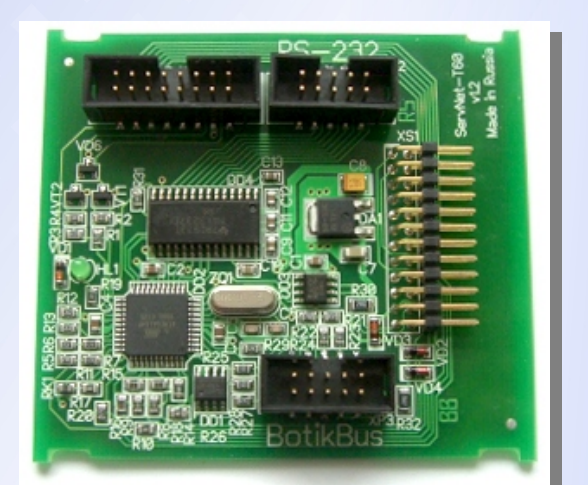
### Modules



Base module 1  
(81×45 mm)



Power supply module  
(83×37 mm)



Servnet-T60  
(80×70 mm)

### ADDRESS

Research Center for  
Multiprocessor Systems  
Program Systems Institute  
Russian Academy of Sciences

Pereslavl-Zalessky  
Yaroslavl Region  
Russia, 152020  
Tel/Fax: +7 (48535) 98064  
E-mail: [abram@botik.ru](mailto:abram@botik.ru)  
Web-site: <http://www.botik.ru/PSI/RCMS>

