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Device Management

in a connected society

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Outline

- Background
- Device Managment
- Protocols
- Exosense
- Demo

Background

- Device management 2003-2007
- Solved the “MMS problem”
- Early OMA/DM implementation
- Apple & Android is changing the market

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Device Managment - DM

“Device Management is a set of technologies, protocols and standards used to allow the remote management of devices, often involving updates of firmware.”

DM system

- Device management server
- Wired or wireless devices
  - Mobile phones (MDM)
  - Network elements (NM)
  - Embedded systems (M2M)

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DM process

- Detection
- Bootstrap
- Provisioning
- Managment (Firmware & Config)
- Monitoring
- Deprovisioning

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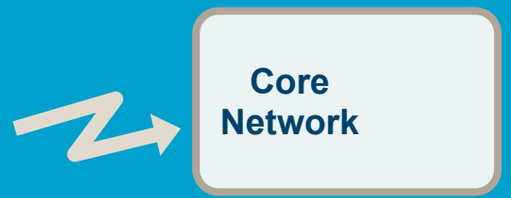
DM over the air



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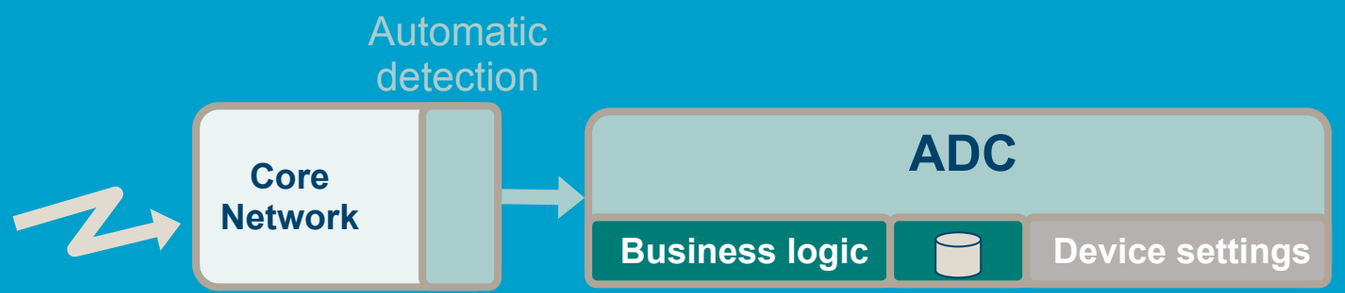

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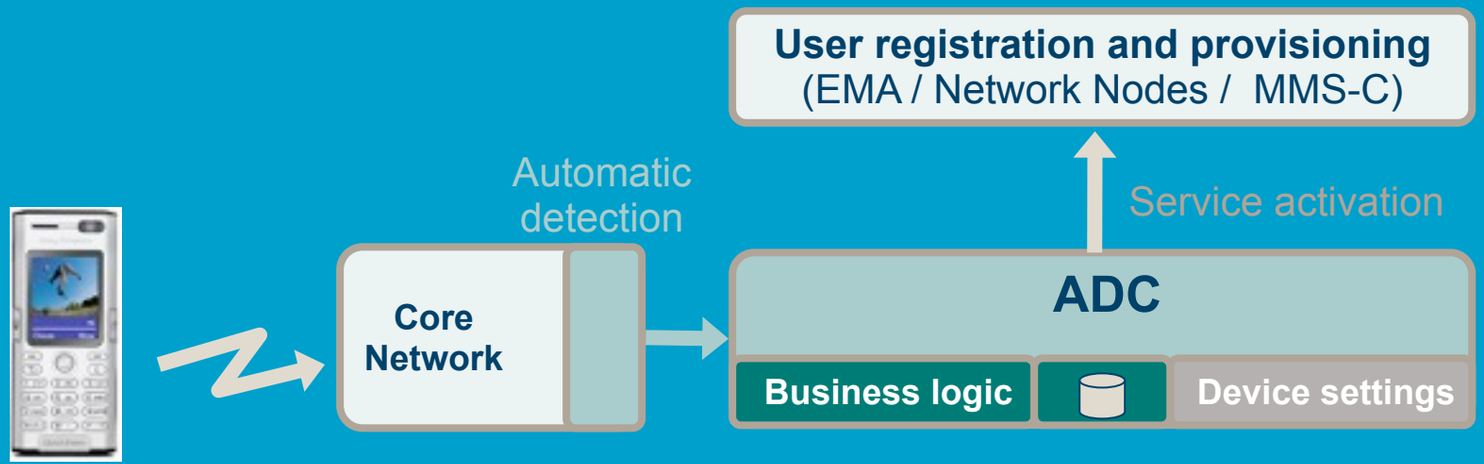

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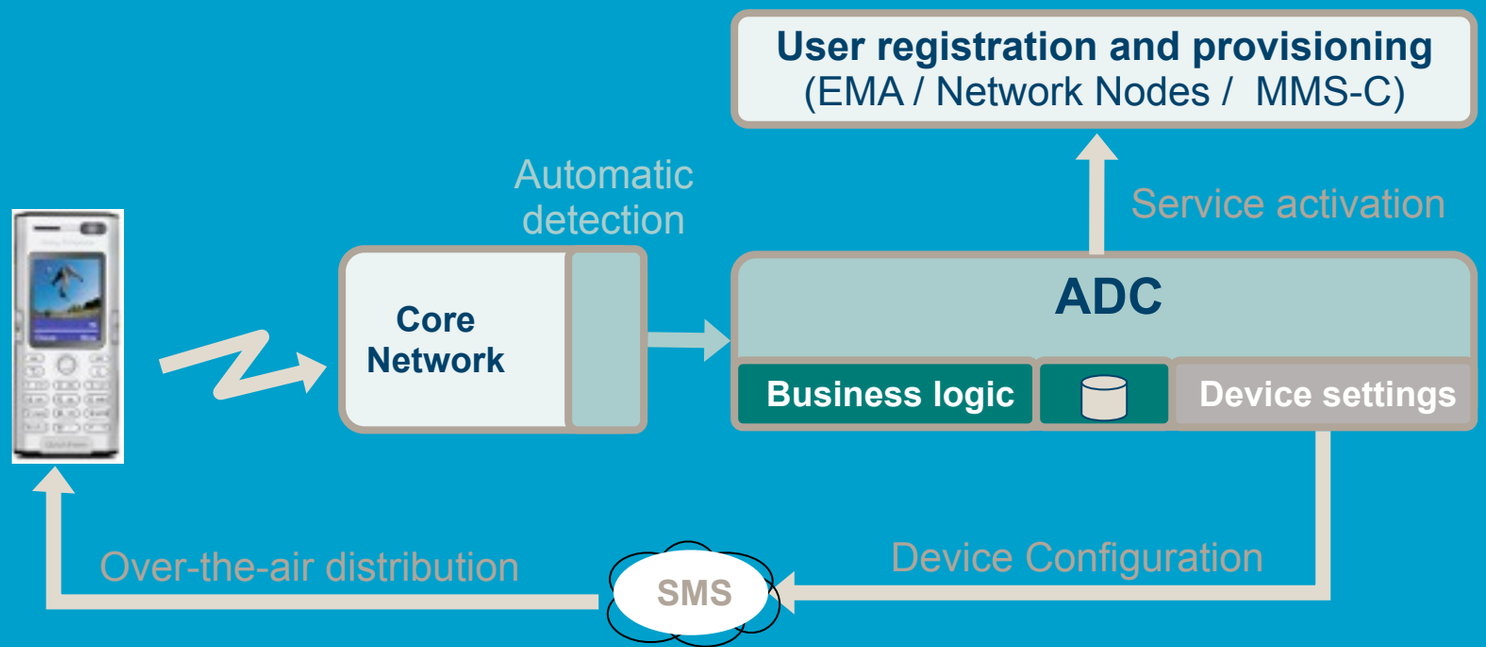

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WAP Provisioning document

```
<?xml version="1.0"?>
<!DOCTYPE wap-provisioningdoc PUBLIC "-//WAPFORUM//DTD PROV 1.0//EN"
  "http://www.wapforum.org/DTD/prov.dtd">

<wap-provisioningdoc>
 <characteristic type="PXLOGICAL">
   <parm name="PROXY-ID" value="170.187.51.4"/>
   <parm name="NAME" value="BankMainProxy"/>
   <parm name="STARTPAGE" value="http://www.bank.com/startpage.wml"/>
   <characteristic type="NAPDEF">
    <parm name="NAPID" value="NAP1"/>
    <parm name="BEARER" value="GSM-CSD"/>
    <parm name="NAME" value="MY ISP CSD"/>
    <parm name="NAP-ADDRESS" value="+35808124002"/>
    <parm name="NAP-ADDRTYPE" value="E164"/>
    <parm name="CALLTYPE" value="ANALOG_MODEM"/>
    <characteristic type="NAPAUTHINFO">
     <parm name="AUTHTYPE" value="PAP"/>
     <parm name="AUTHNAME" value="wwwmmmuser"/>
     <parm name="AUTHSECRET" value="wwwmmmsecret"/>
    </characteristic>
  </characteristic>
</characteristic>
</wap-provisioningdoc>
```

WBXML

- Wireless Binary XML
- Reduce the size of the XML document
- Tags and strings may be encoded with one byte
- Using a page scheme
- Scheme needs to be known by both parties

SMSC - connectivity

- PPG - Push proxy gateway
- SMPP - Short Message Peer to Peer (Aldiscon)
- UCP - Universal Computer Protocol (CMG)
- CIMD-2 - Computer Interface to Message Distribution (Nokia)

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OTA settings

- Ericsson/Nokia OTA settings
- OpenWave Primary Provisioning
- WAP Client Provisioning 1.0
- OMA – Client Provisioning Spec

OTA services

- GPRS (basic), WAP (browser)
- MMS, POC (push to talk), WV (wireless village)
- SyncML (DS/DM)
- E-Mail, Wireless AP

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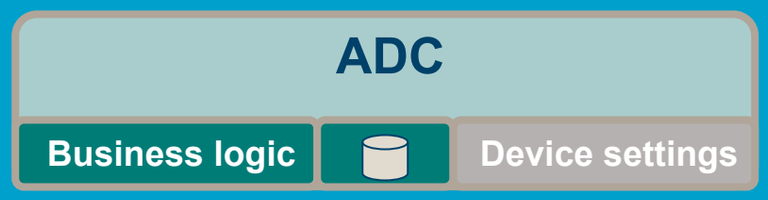
OMA/DM


DM1


DM2


Customer support



Interactive session setup

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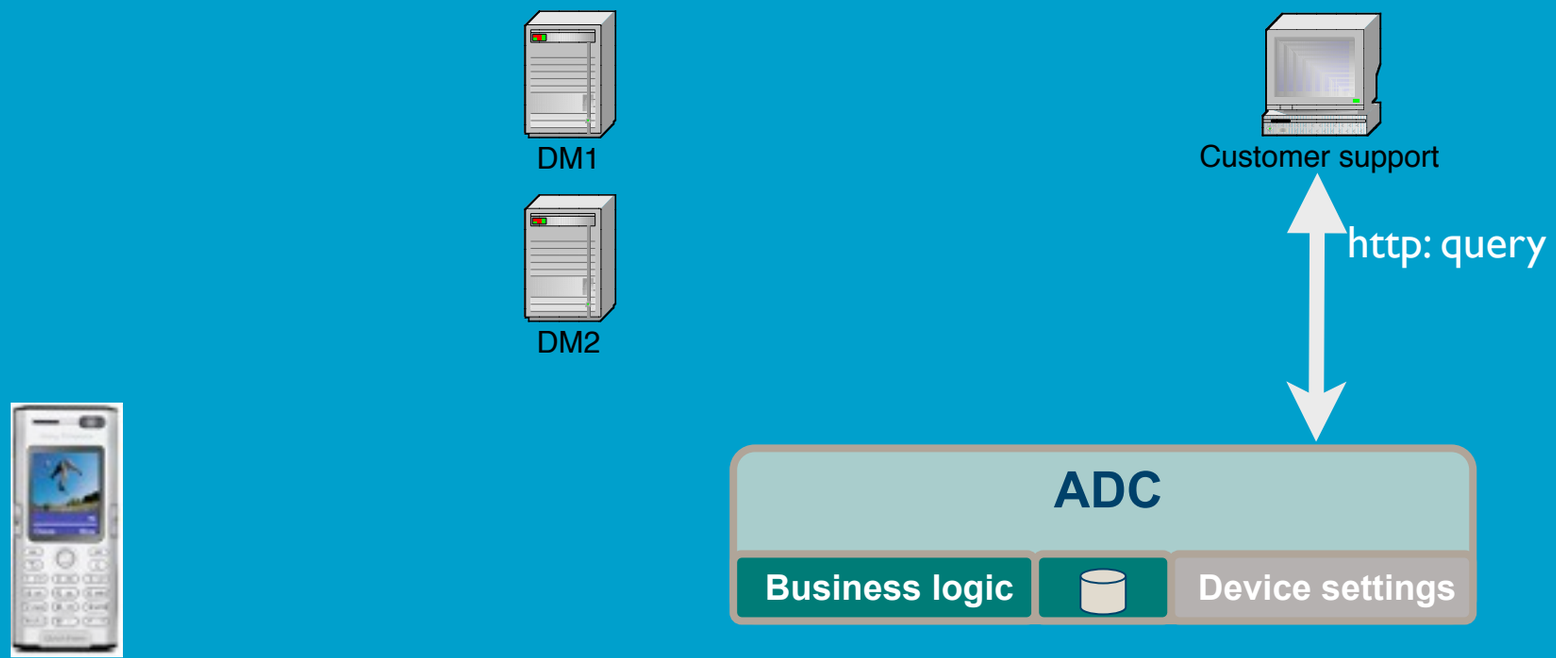
OMA/DM



Interactive session setup

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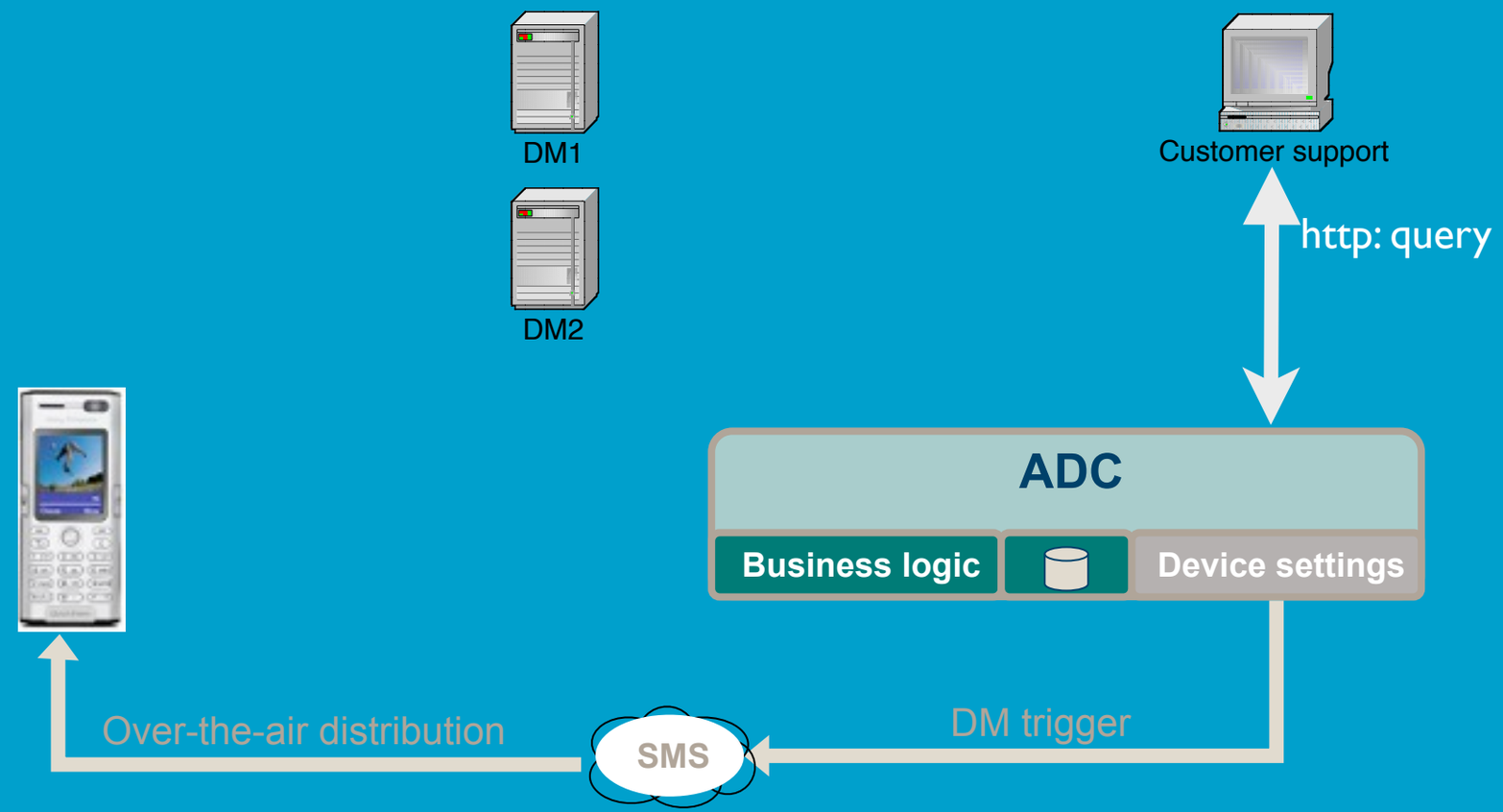

Interactive session setup

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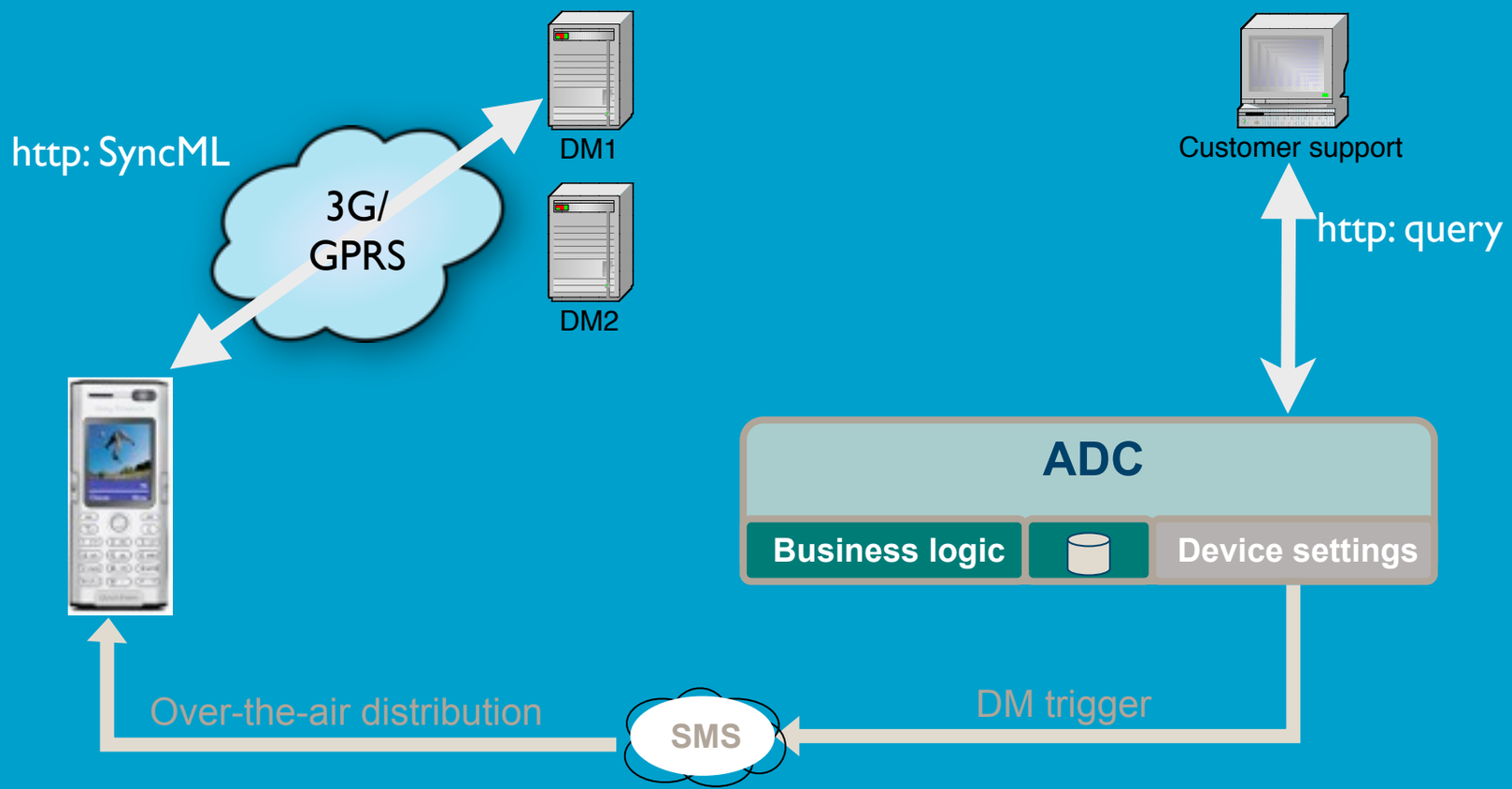

Interactive session setup

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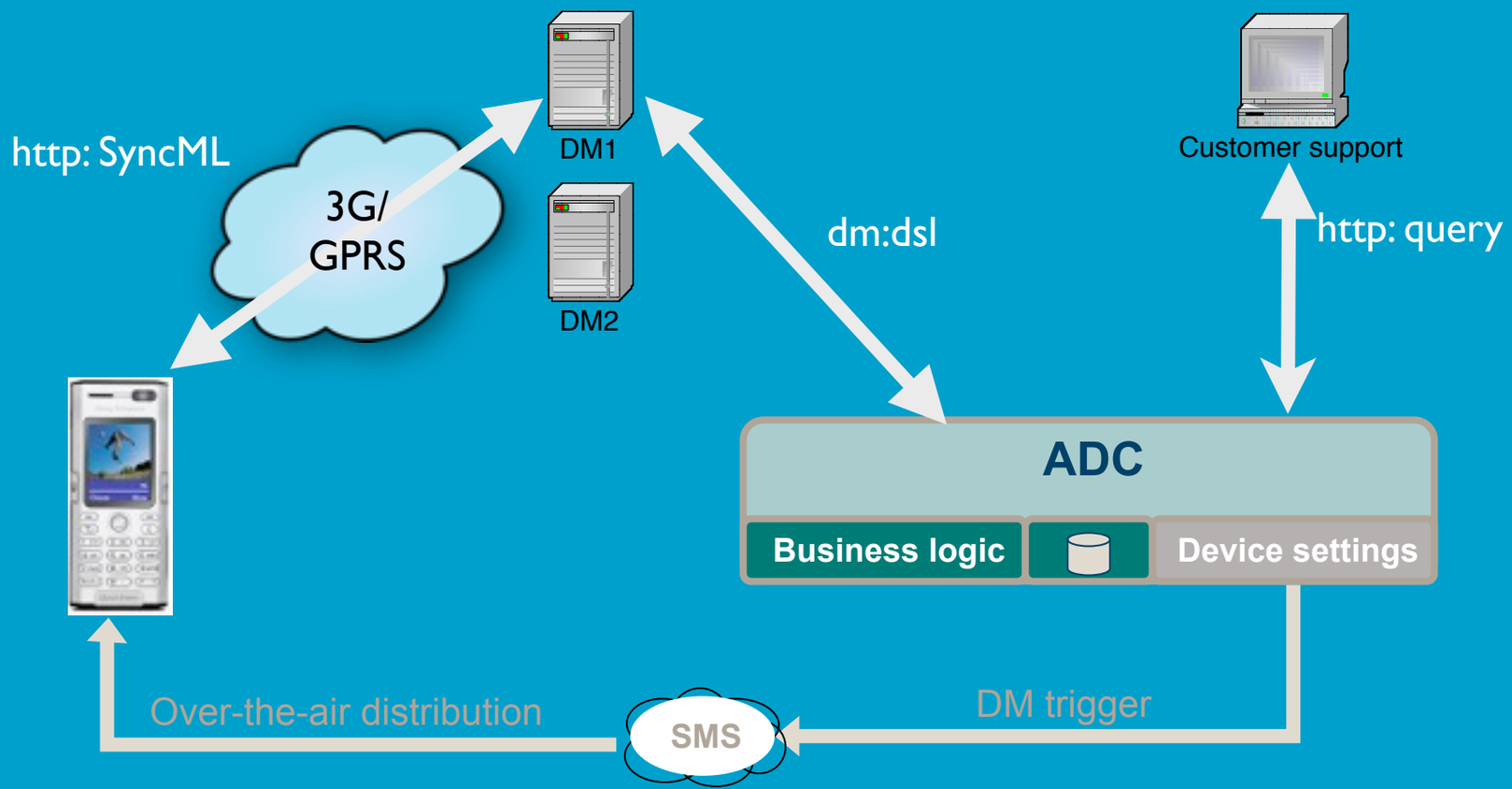

Interactive session setup

Protocols

Protocol	Standard	Types	Model	Transport
SNMP	IETF	Network equipment	MIB	UDP
TR-069	Broadband Forum	CPE devices, set-top boxes, modem	XML-Schema	SOAP/ HTTP
OMA/DM	OMA	Mobile phones	DTD	SyncML/ HTTP
Netconf	IETF	Network equipment	YANG	SSH

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SNMP

- SET/GET defined by MIB
- send TRAPs alarms, notifications
- Used by most network equipment today
- MIB data model

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IF-MIB.mib

```
-- the Interfaces table

-- The Interfaces table contains information on the entity's

-- interfaces.  Each sub-layer below the internetwork-layer
-- of a network interface is considered to be an interface.

ifTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IfEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
            "A list of interface entries. The number of entries is
            given by the value of ifNumber."
    ::= { interfaces 2 }

ifEntry OBJECT-TYPE
    SYNTAX      IfEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
            "An entry containing management information applicable to a
            particular interface."
    INDEX   { ifIndex }
    ::= { ifTable 1 }
```

```
IfEntry ::=
    SEQUENCE {
        ifIndex             InterfaceIndex,
        ifDescr              DisplayString,
        ifType              IANAifType,
        ifMtu               Integer32,
        ifSpeed              Gauge32,
        ifPhysAddress          PhysAddress,
        ifAdminStatus          INTEGER,
        ifOperStatus           INTEGER,
        ifLastChange           TimeTicks,
        ifInOctets            Counter32,
        ifInUcastPkts          Counter32,
        ifInNUcastPkts          Counter32,  -- deprecated
        ifInDiscards           Counter32,
        ifInErrors            Counter32,
        ifInUnknownProtos       Counter32,
        ifOutOctets            Counter32,
        ifOutUcastPkts          Counter32,
        ifOutNUcastPkts         Counter32,  -- deprecated
        ifOutDiscards          Counter32,
        ifOutErrors            Counter32,
        ifOutQLen               Gauge32,    -- deprecated
        ifSpecific            OBJECT IDENTIFIER -- deprecated
    }
```

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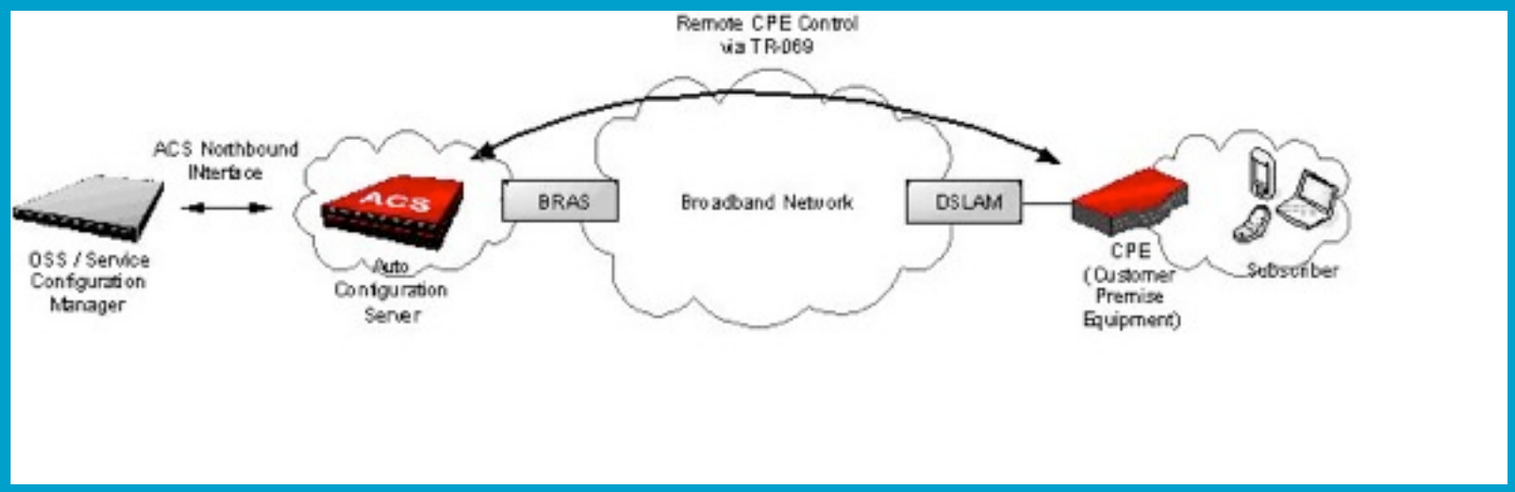
TR-069

- GetParameterValues/SetParameterValues
- Upload/Download
- CPE devices
- XMLSchema & PDF data model



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tr-069-1-0-0.xml

```
<object
  name="InternetGatewayDevice.LANDevice.{i}.LANEthernetInterfaceConfig.
{i}."
   access="readOnly" minEntries="0" maxEntries="unbounded"
   numEntriesParameter="LANEthernetInterfaceNumberOfEntries">
   <description>This object models an Ethernet LAN connection on a CPE
device.
        This object must be implemented for CPE that contain an Ethernet
interface
        on the LAN side.
   </description>
   <uniqueKey>
     <parameter ref="MACAddress"/>
   </uniqueKey>
   <parameter name="Enable" access="readWrite">
   <description>Enables or disables this interface.</description>
   <syntax>
     <boolean/>
    </syntax>
  </parameter>
       ...
  <parameter name="MACAddress" access="readOnly">
     <description>The physical address of the interface.</description>
     <syntax>
       <dataType ref="MACAddress"/>
     </syntax>
  </parameter>
       ....
</object>
```

```
<parameter name="MACAddressControlEnabled" access="readWrite">
  <syntax>
    <boolean/>
  </syntax>
  </parameter>
  <parameter name="MaxBitRate" access="readWrite">
  <description>The maximum upstream and downstream bit rate
      available to this connection.
  </description>
  <syntax>
    <string>
      <enumeration value="10"/>
      <enumeration value="100"/>
      <enumeration value="1000"/>
      <enumeration value="Auto"/>
    </string>
  </syntax>
  </parameter>
  <parameter name="DuplexMode" access="readWrite">
    <description>The duplex mode available to this connection.</description>
    <syntax>
    <string>
      <enumeration value="Half"/>
      <enumeration value="Full"/>
      <enumeration value="Auto"/>
    </string>
  </syntax>
</parameter>
```

Netconf

- get-config/edit-config
- notification
- RPC based
- SSH
- YANG data models

IF-MIB.yang

```
list ifEntry {

  key "ifIndex";
  description
    "An entry containing management information applicable to a
     particular interface.";
  smi:oid "1.3.6.1.2.1.2.2.1";

  leaf ifIndex {
    type if-mib:InterfaceIndex;
    // config false;
    description
      "A unique value, greater than zero, for each interface.  It
       is recommended that values are assigned contiguously
       starting from 1. The value for each interface sub-layer
       must remain constant at least from one re-initialization of
       the entity's network management system to the next re-
       initialization.";
    smi:oid "1.3.6.1.2.1.2.2.1.1";
  }
...
```

```
    leaf ifMtu {
      type int32;
      config false;
      description
        "The size of the largest packet which can be sent/received
         on the interface, specified in octets.  For interfaces that
         are used for transmitting network datagrams, this is the
         size of the largest network datagram that can be sent on the
         interface.";
      smi:oid "1.3.6.1.2.1.2.2.1.4";
    }

    leaf ifSpeed {
      type yang:gauge32;
      config false;
      description
        "An estimate of the interface's current bandwidth in bits
         per second.  For interfaces which do not vary in bandwidth
         or for those where no accurate estimation can be made, this
         object should contain the nominal bandwidth.  If the
         bandwidth of the interface is greater than the maximum value
         reportable by this object then this object should report its
         maximum value (4,294,967,295) and ifHighSpeed must be used
         to report the interace's speed.  For a sub-layer which has
         no concept of bandwidth, this object should be zero.";
      smi:oid "1.3.6.1.2.1.2.2.1.5";
    }
```

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Exosense

- Store and forward RPC engine
- Like Netconf set-config/get-config
- Uses BERT-RPC instead of SOAP/XML
- Uses JSON-RPC on the customer application
- YANG data model

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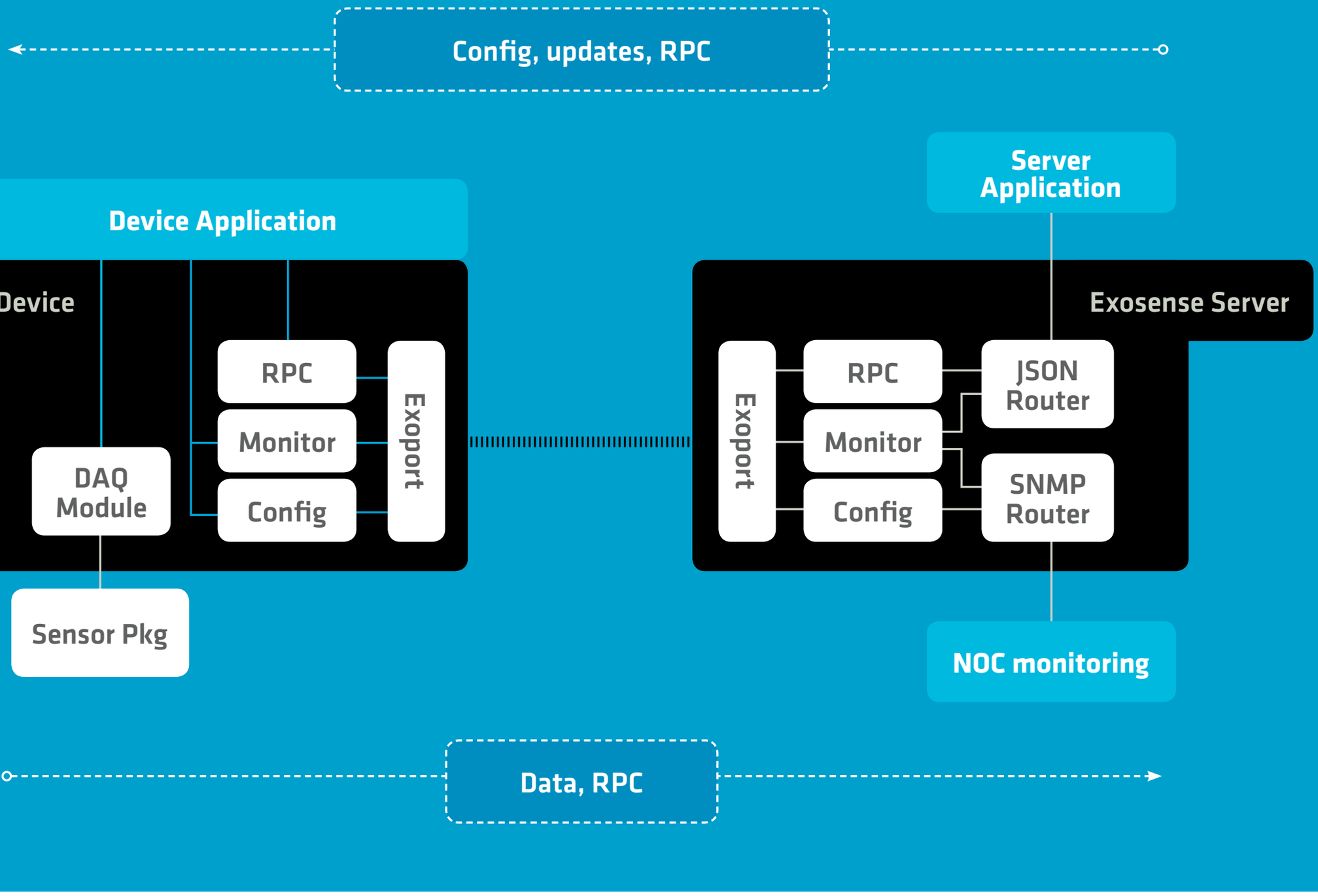
Exosense



Exosense challenges

- Heterogeneous devices.
- Data budget: 50*10^9*0.69 SEK = 3,8 Billion EUR per ping.
- Persistence, scalability, redundancy
- Promote Erlang devices
- “Command line simple”

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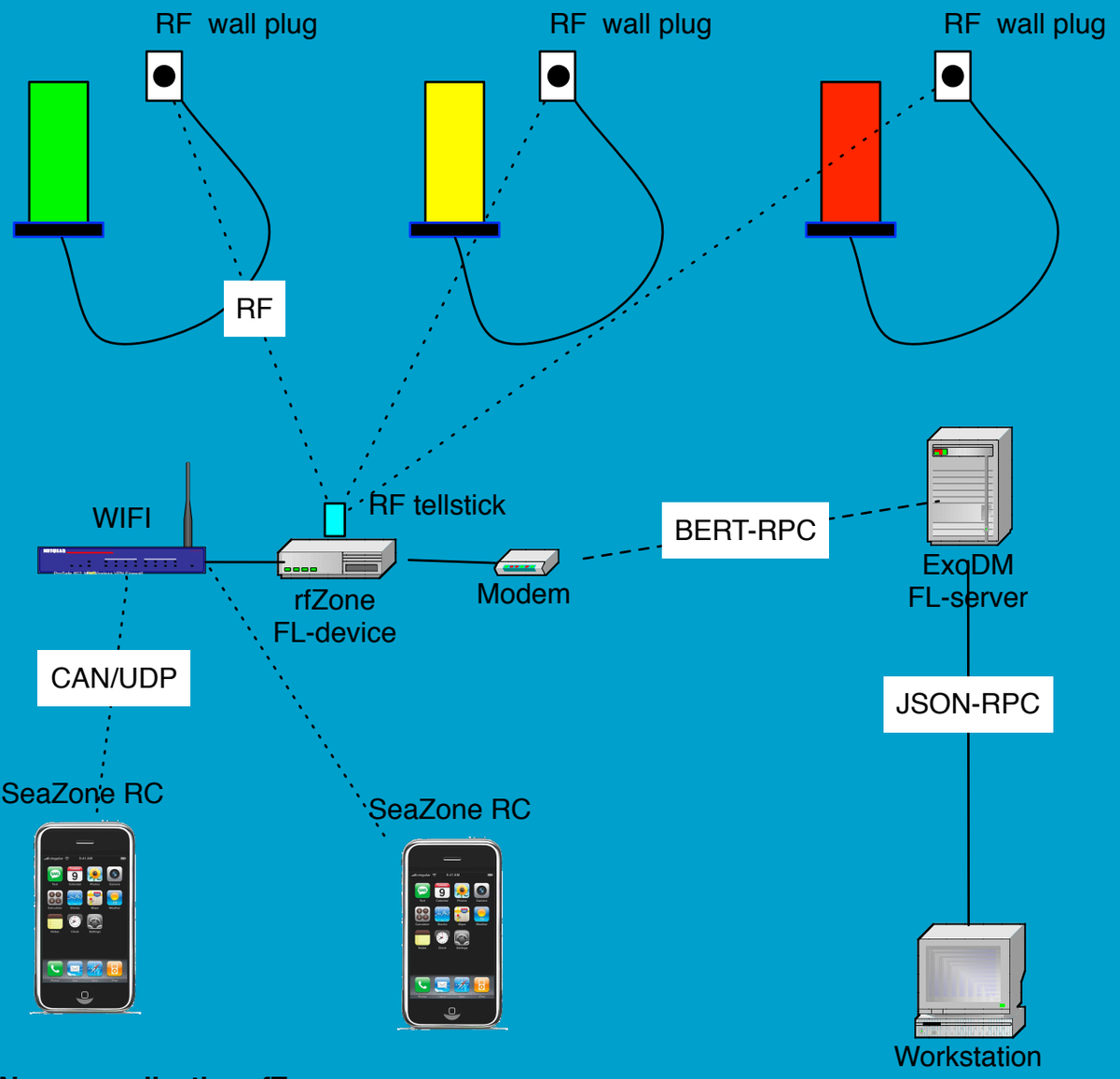
DEMO



CANopen application rfZone

- Controlled by SeaZone RC
- CAN frames formatted as UDP packets
- rfZone sends commands via RF
- rfZone accepts commands from ExoDM

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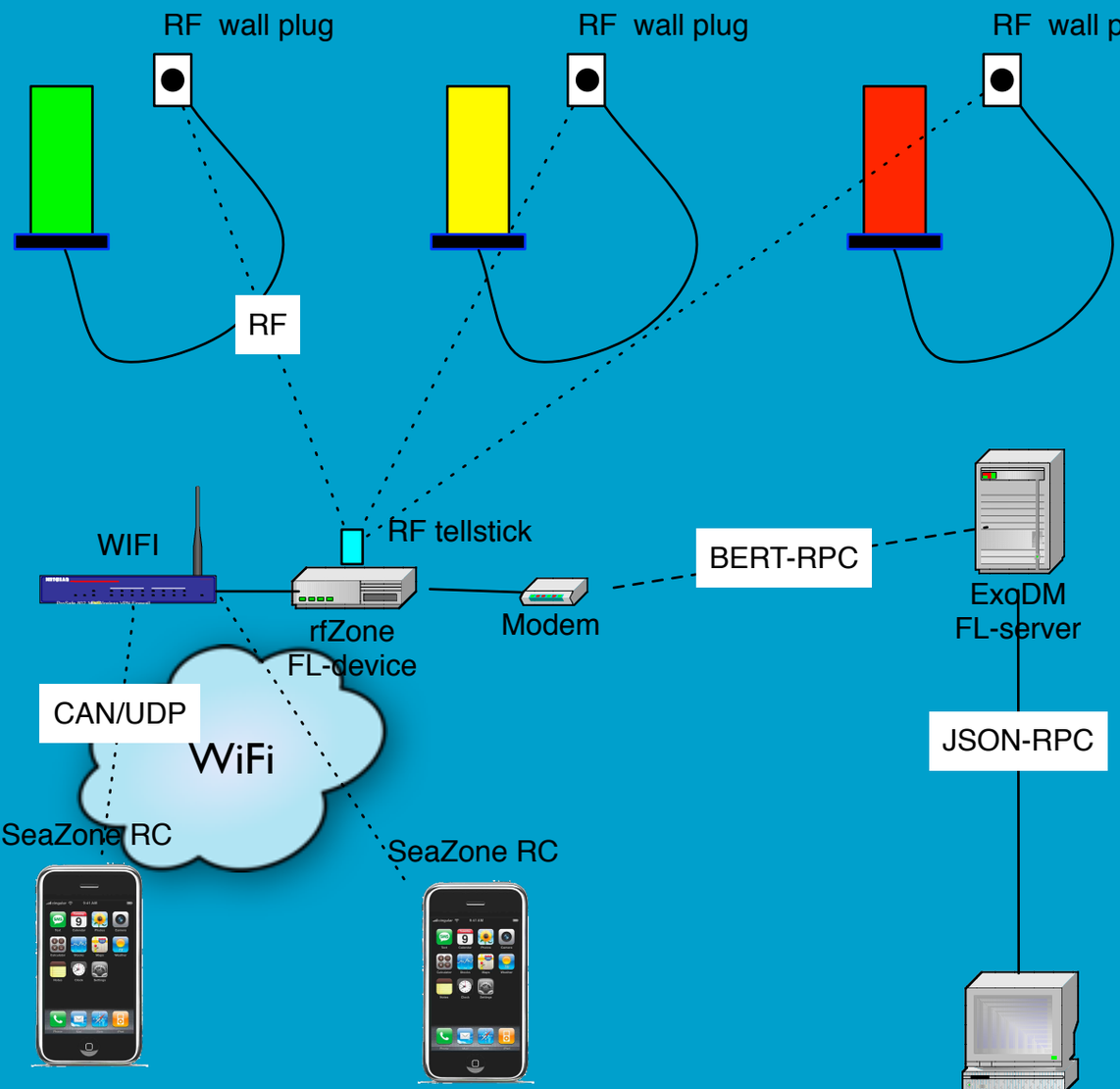
DEMO



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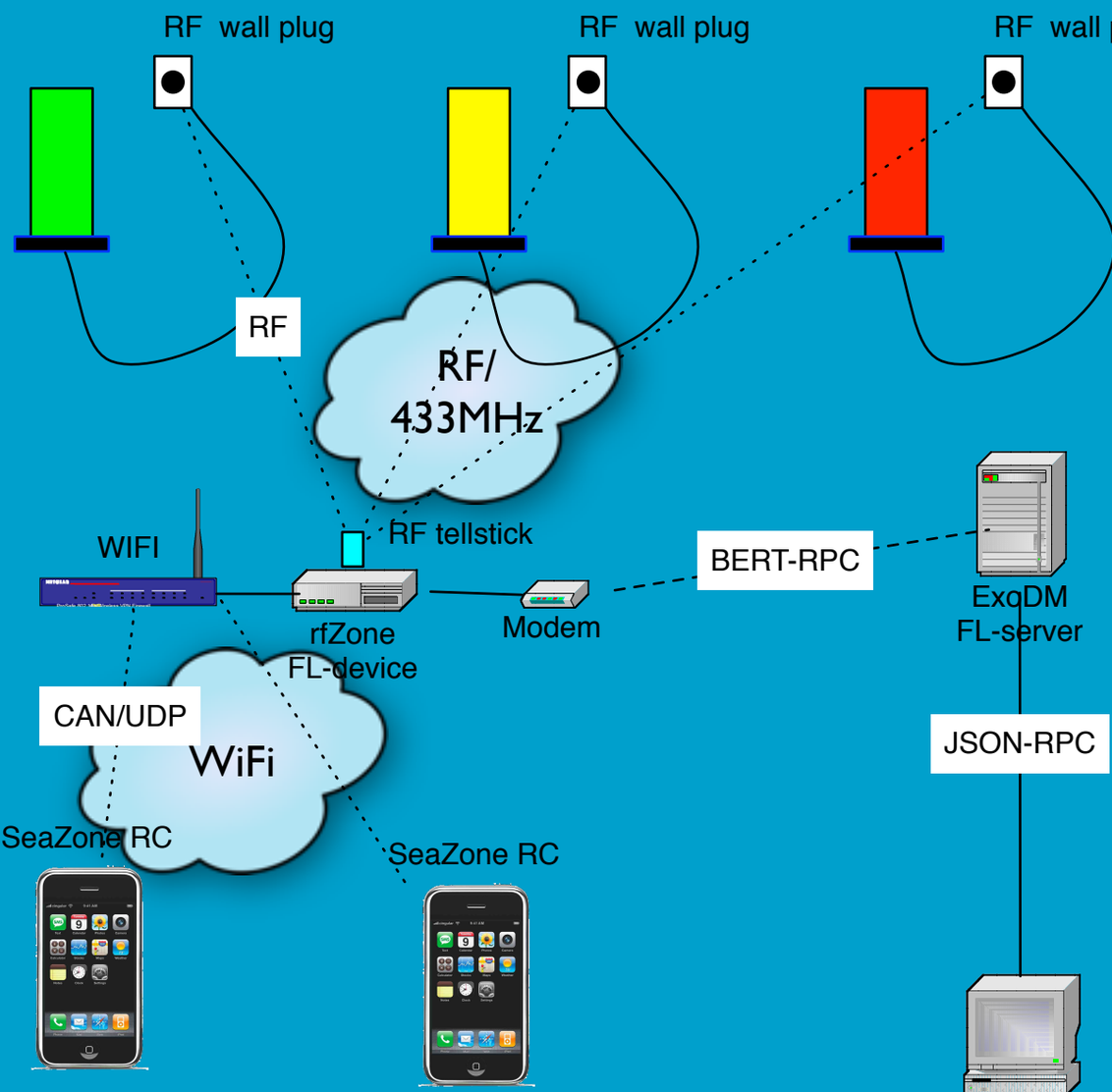

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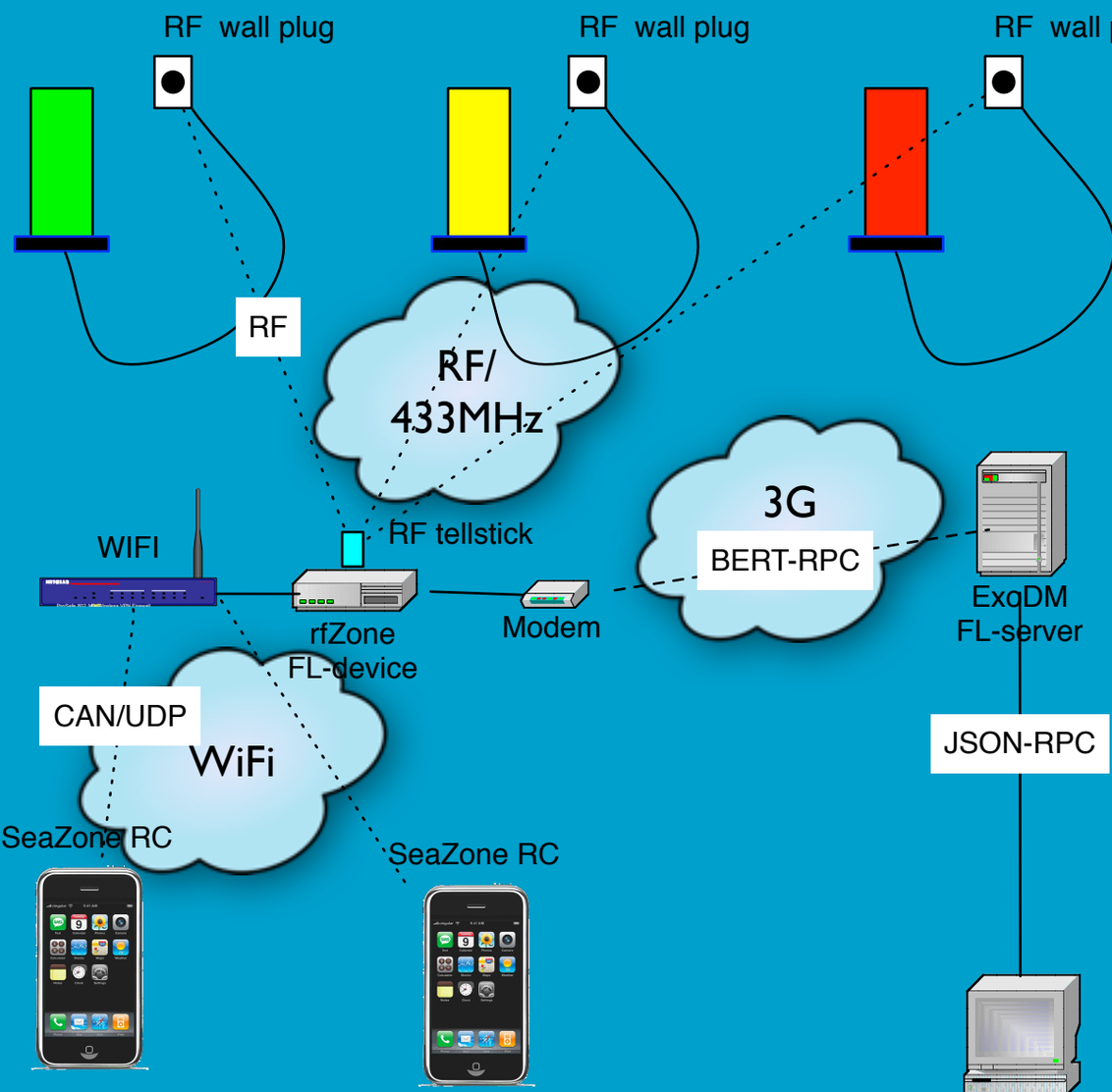

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Thanks

Questions?