Delivering high performance Internet of Things services

Jfokus Embedded, February 2013

Lars Ramfelt, CEO

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About Us.

- World leading Internet-of-Things solution, for industrial sites, proven with revenue generating lead customers.

- Scalable architecture to 100+ million locations.

- Intel and Ericsson aligned vision and collaboration.

- World class software and hardware Internet-of-Things technology and entrepreneur team.
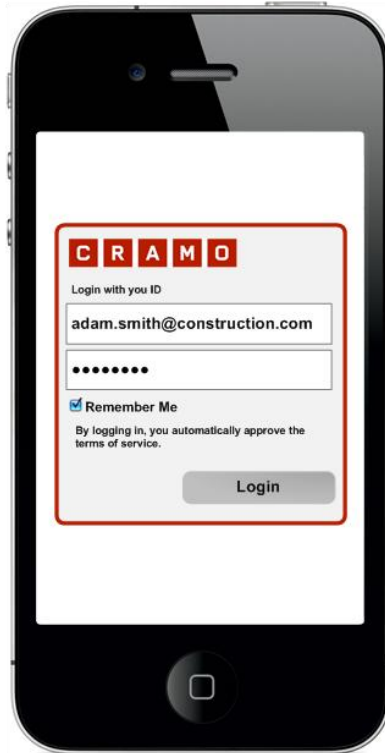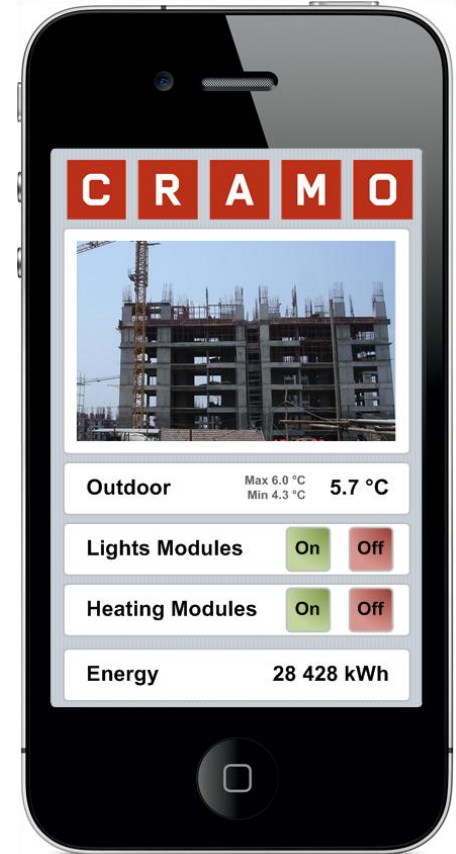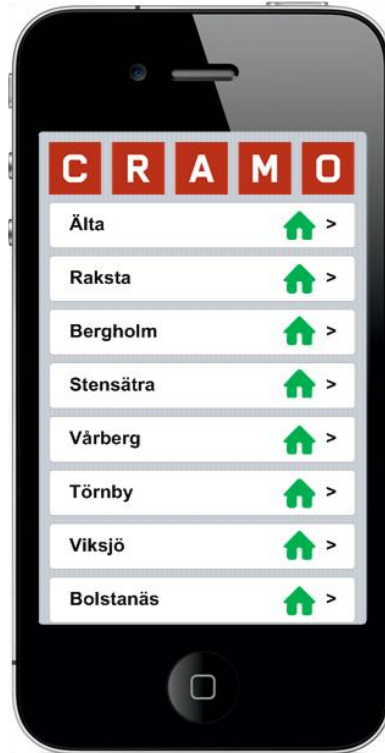
Three Clicks is Enough.

Launch App
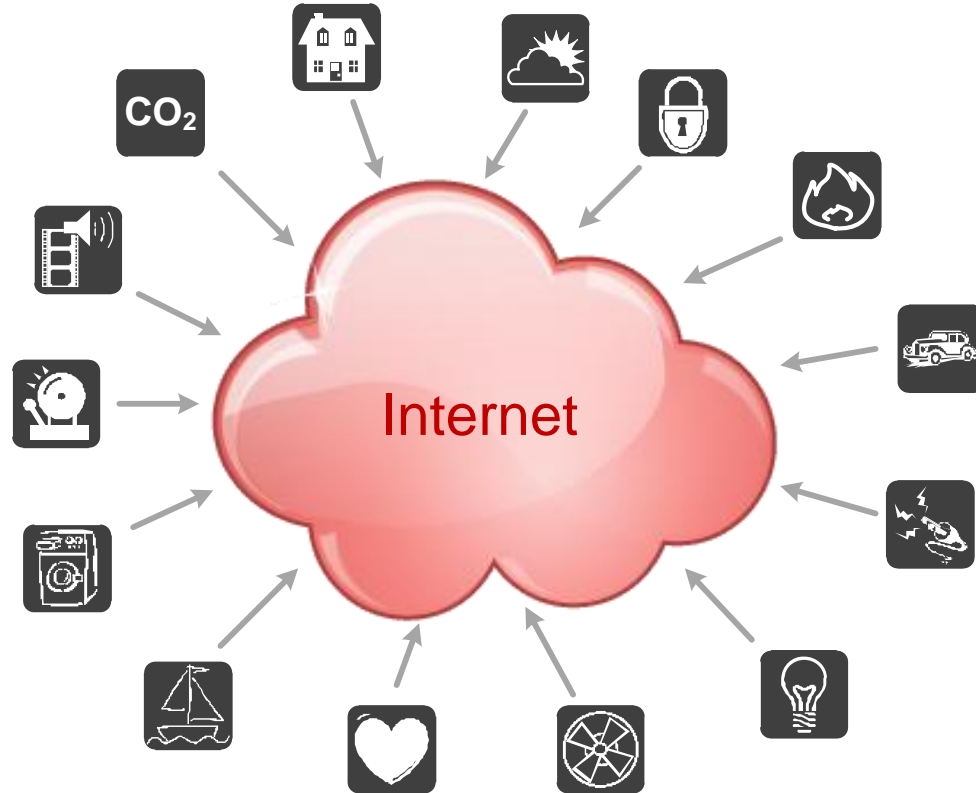
Login

Select Location
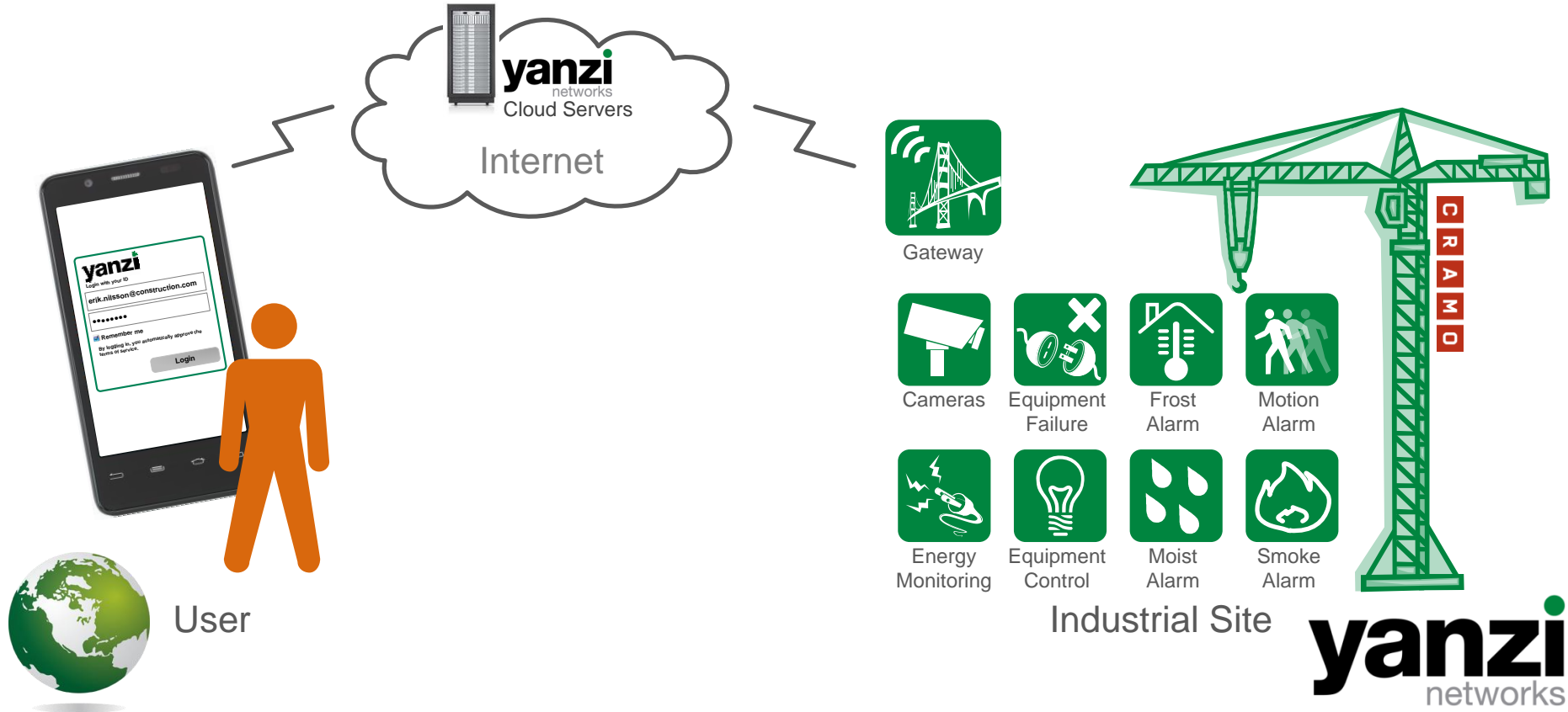
Our Mission: Getting Things Online!

And provide a rich and real-time user experience with images and video.

Internet

System Overview.

Internet

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Cloud Servers

Gateway

Cameras

Equipment Failure

Frost Alarm

Motion Alarm

Energy Monitoring

Equipment Control

Moist Alarm

Smoke Alarm

Industrial Site

User

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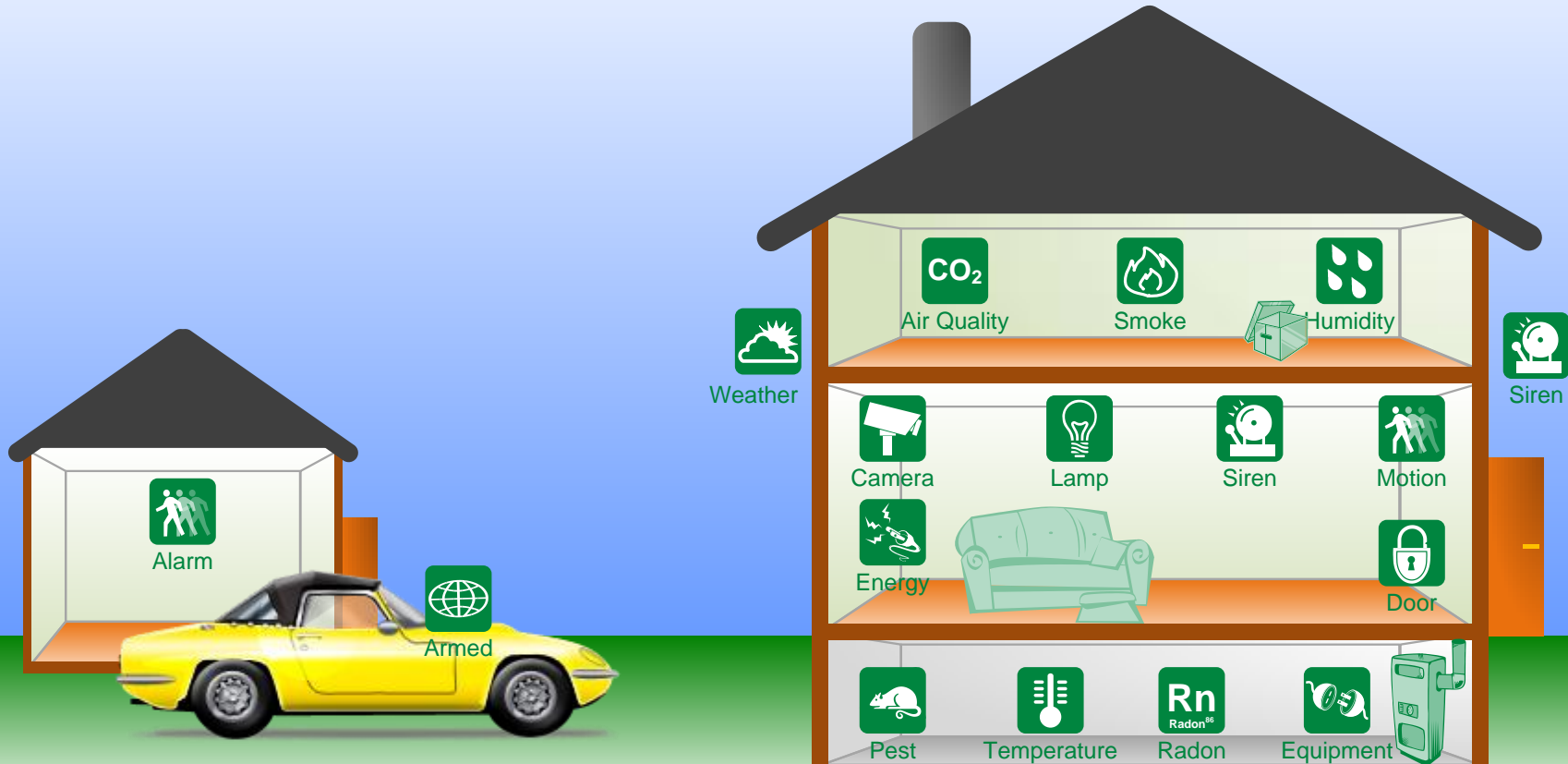
Sensors.

Internet-of-Things.
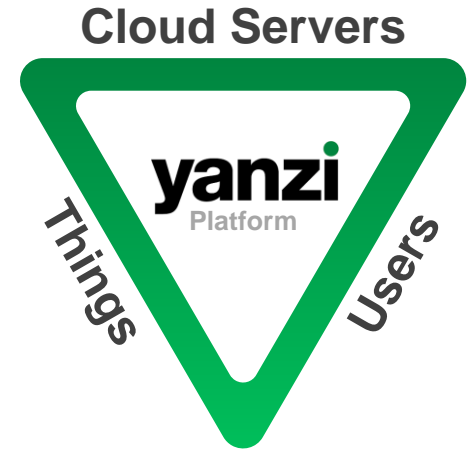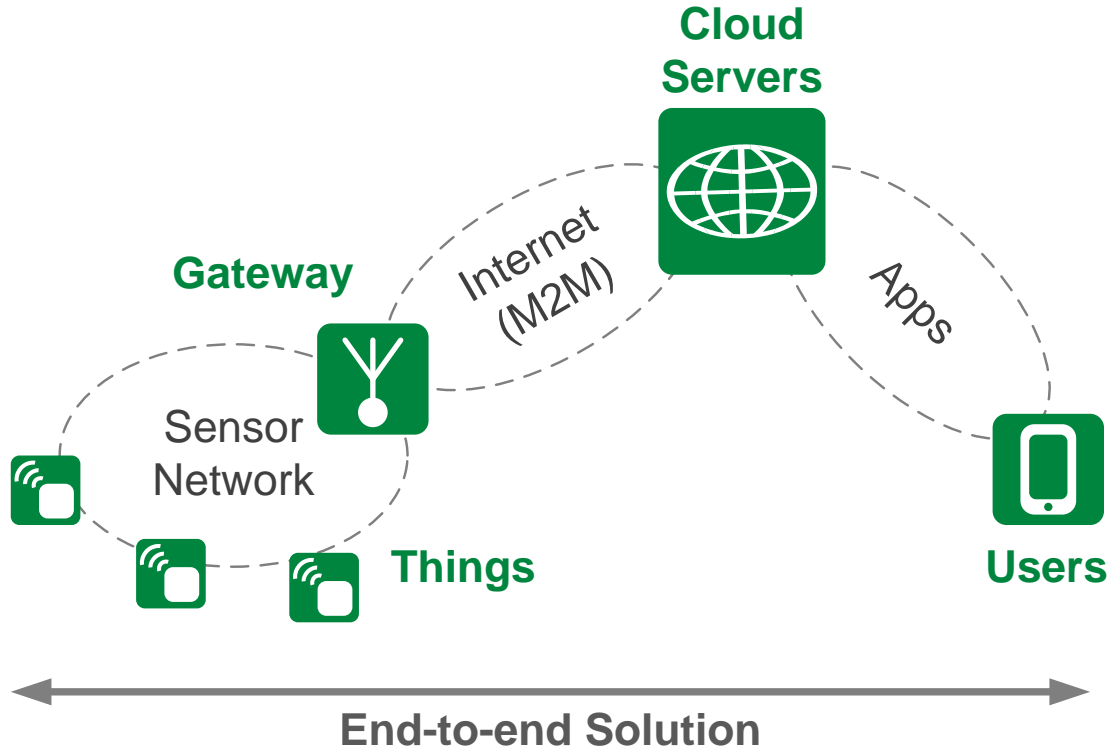
Challenges.

- Scalability
  - Many locations
  - Many sensors per location
  - Amount of data
  - Need to support low cost to high performance solutions

- Large variation in Internet connectivity
  - Loss, delay, performance, cost, availability
  - Real-time control

- Large variation of connected sensors
  - Legacy – Modbus, 1-wire, CAN, etc
  - Video – Smart capacity usage

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Ugly Looking Reality.

Cloud Server

Internet

Users

2G/3G, ADSL, Cable, Ethernet, etc

Micro Gateway

Gateway

Modbus

Ethernet

Wi-Fi

Wi-Fi

PoE

Adapter

Adapter

Adapter

Wi-Fi

802.15.4

802.15.4

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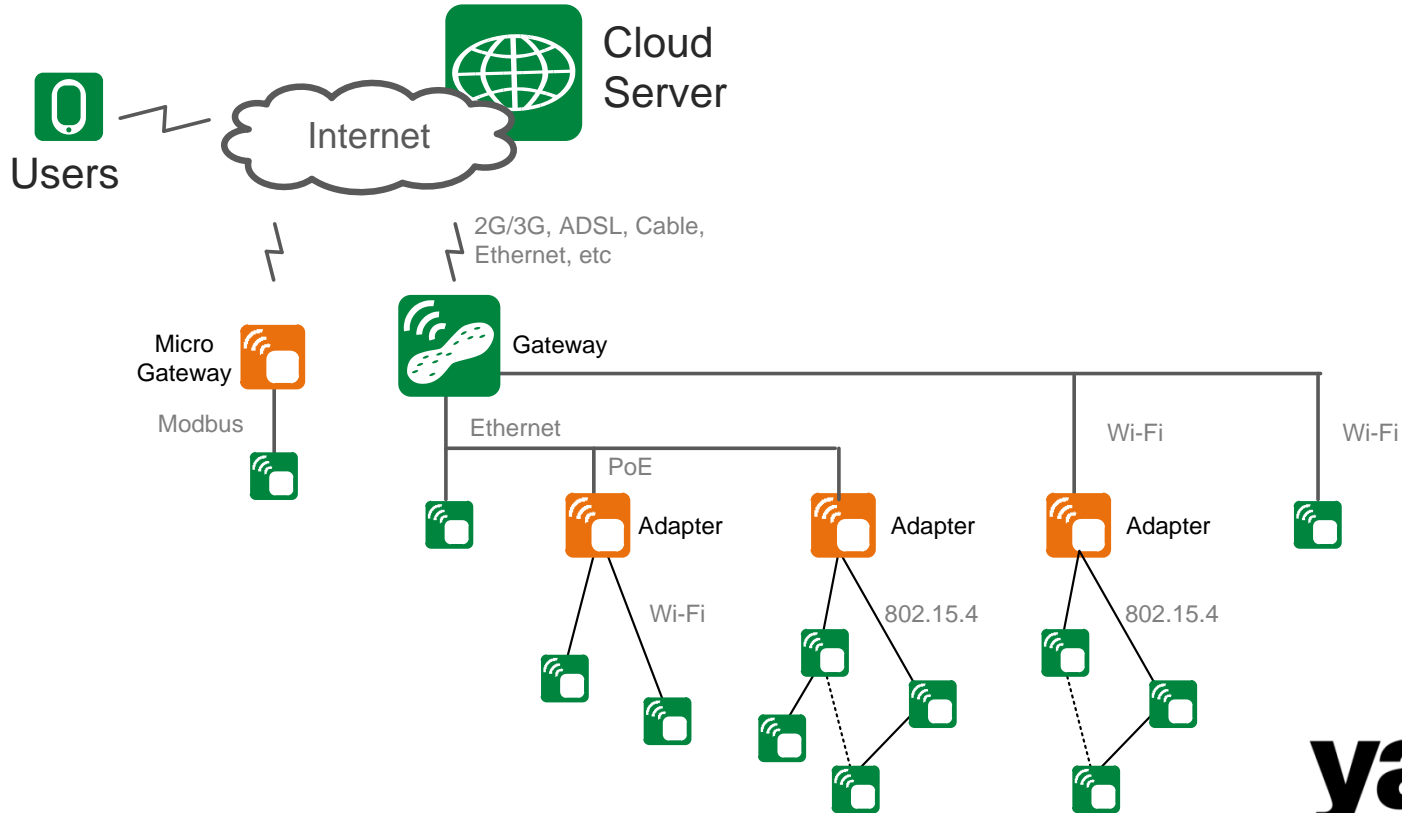
"Requirement"

- Horizontal application
  - Mix of services, low speed sensors, high speed video, local storage, remote storage, all in same system.

- All networking provided by IP (IPv6)
  - No reliance on proprietary networking layers

- Zero-configuration network setup
  - Automatic discovery
  - Automatic provisioning (individual security)
  - Automatic firewall traversal
  - Automatic device management
    - Fault detection, remote upgrade, etc

- Multi platform software implementation
  - Shared between Cloud and Gateway

- State-less sensors and state-full Java servers

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Virtual Device Driver.
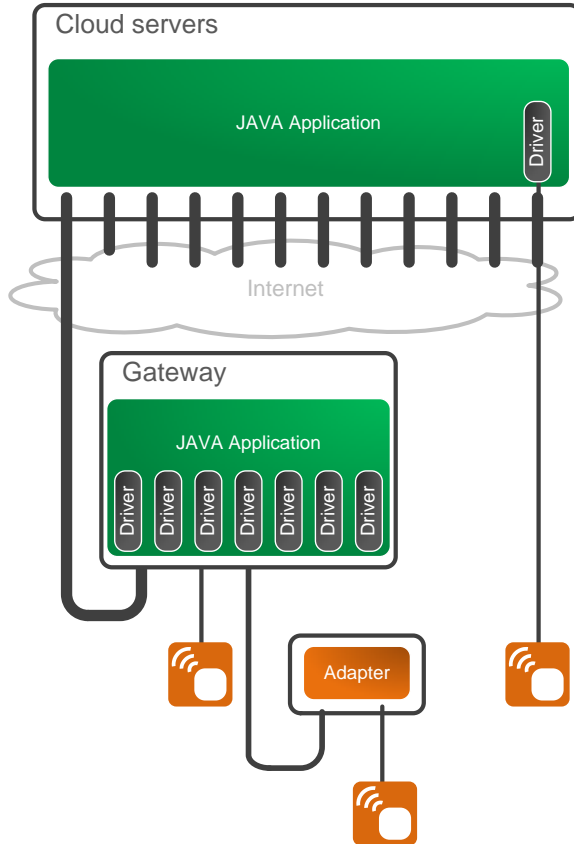
- IP-based hardware abstraction layer (HAL)

- Allows for virtual device driver inside the Java framework
  - Lower support cost
  - Higher functionality
  - Better code reuse

Partition of Functionality.

✓ Secure
✓ Client software updates
✓ Backup
✓ Real-time notifications
✓ Provisioning

Cloud Servers

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Platform

Objects

Users

✓ Zero configuration
✓ Automatic discovery
✓ Automatic security
✓ Firewall traversal
✓ IPv4 / IPv6

✓ Web or App based
✓ Single sign-on
✓ Aggregated view of locations
✓ Aggregated view of objects

Platform Architecture.
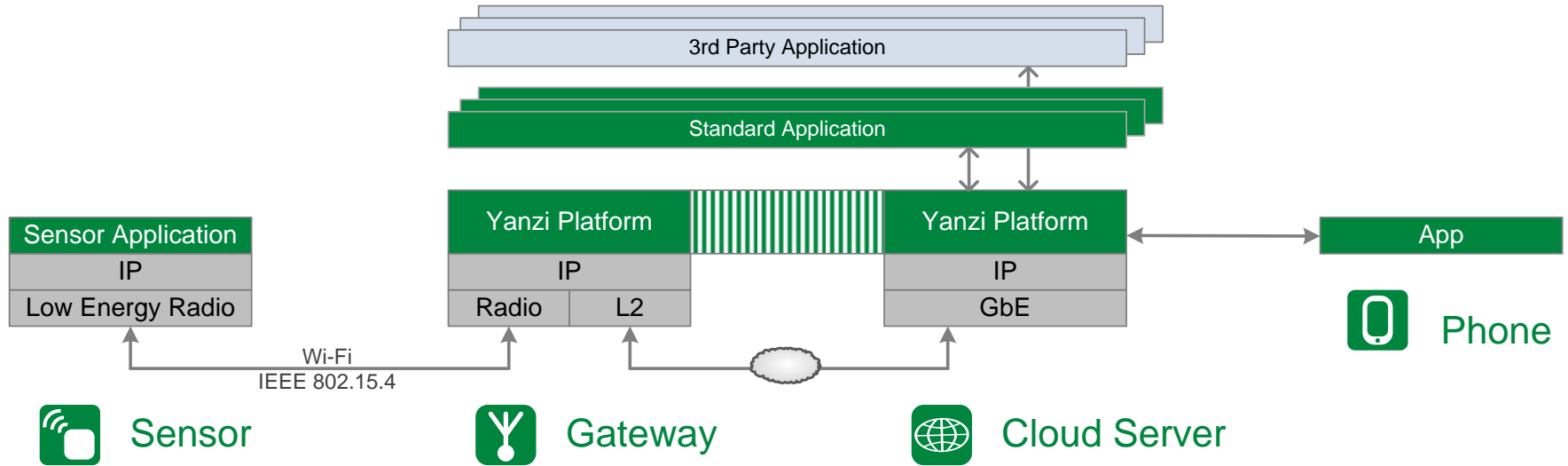
Sensor.
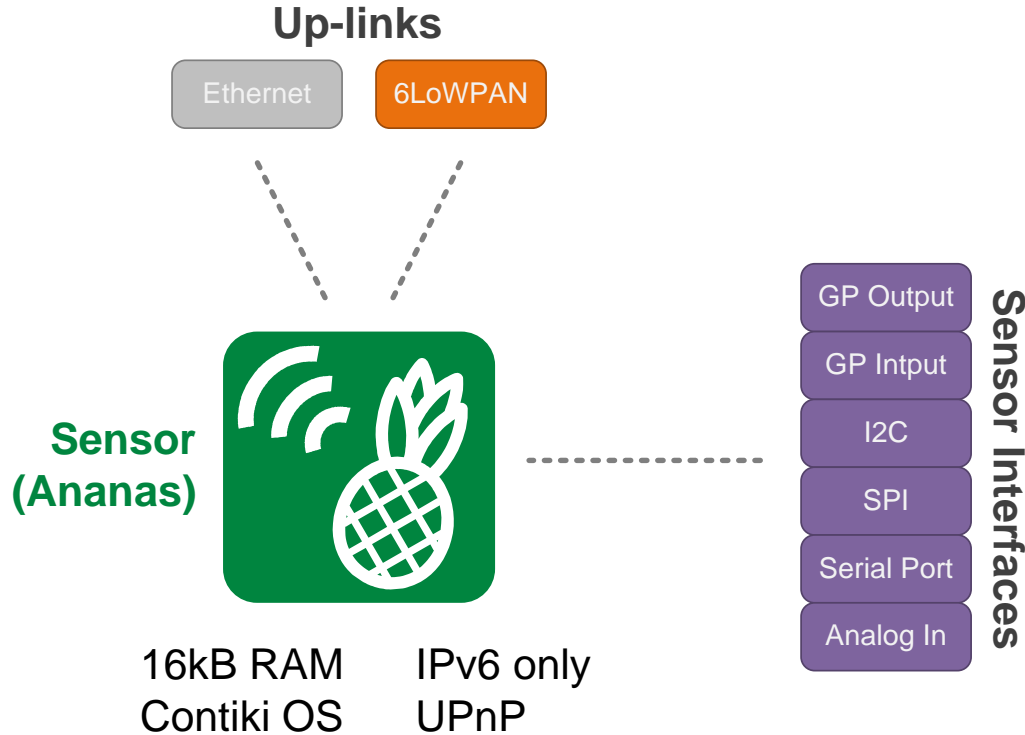
Up-links

Ethernet   6LoWPAN

Sensor (Ananas)

Sensor Interfaces:
- GP Output
- GP Intput
- I2C
- SPI
- Serial Port
- Analog In

16kB RAM   IPv6 only
Contiki OS   UPnP

Interface	Application Examples
GP Output	Lamp, Heating, Gate
GP Input	Generic Alarm, Motion Detector, Door sensor, Push button
I2C	Accelerometer, Temperature,. Humidity
SPI	Energy Meter, Ethernet, Display, SD Card
Serial port	Weather Station, old stuff
Analog In	Pressure, Temperature, Humidity

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Scaling.

Performance ↑

Stateless

Cloud Server Farm
- High performance
  servers
- Full Java framework
- Large storage
- High performance
  video services

Gateway
- High performance
  embedded Linux
- Full Java framework
- Frequency 0.6 –
  2.0 GHz
- 128MB- 1GB RAM
- Large storage capacity
- Ethernet/3G/LTE
- Flexible aggregation
- Continuous video
  recording

$15

Micro Gateway
- 32 bit μC
- Frequency 50+ MHz
- <0.5MB RAM
- Support for GPRS
  3G/LTE
- Limited storage
- Flexible I/O
- 1+ week of battery
  operation
- Limited aggregation

$5

Sensor platform
- 32 bit μC
- Contiki OS
- Frequency 10+ MHz
- 16kB RAM
- 6LoWPAN
- Flexible I/O
- Up to 10 years
  battery operation

$100

Stateful

Cost / Size / Power

Integrated Dashboard

Controlling Communication Resources
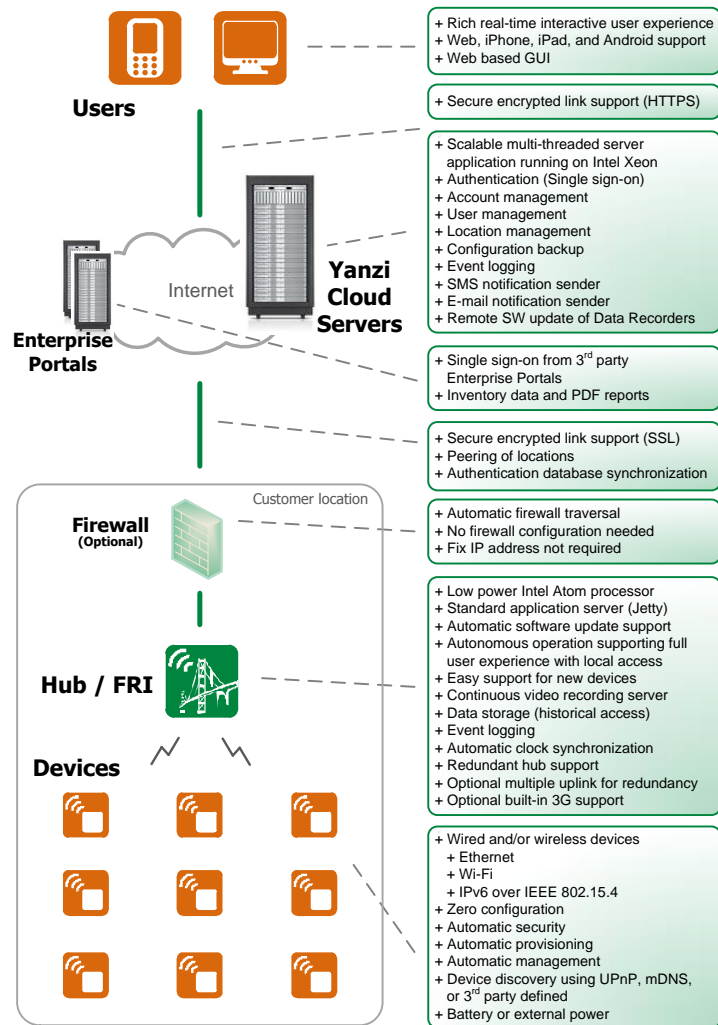
That's It.

Lars Ramfelt
Chief Executive Officer
Yanzi Networks AB
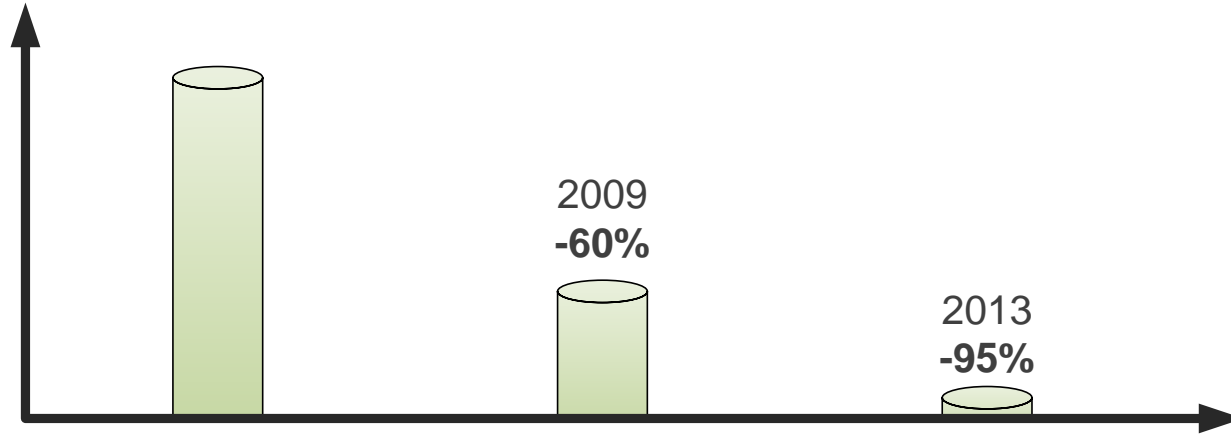
End-to-end Architecture

- ✓ Rich real-time interactive user experience

- ✓ Secure by default

- ✓ Autonomous operation supporting full user experience with local access

- ✓ IP all the way

- ✓ Robust

- ✓ Automatic provisioning

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Users

+ Rich real-time interactive user experience
+ Web, iPhone, iPad, and Android support
+ Web based GUI

+ Secure encrypted link support (HTTPS)

Yanzi Cloud Servers

+ Scalable multi-threaded server application running on Intel Xeon
+ Authentication (Single sign-on)
+ Account management
+ User management
+ Location management
+ Configuration backup
+ Event logging
+ SMS notification sender
+ E-mail notification sender
+ Remote SW update of Data Recorders

Enterprise Portals

Internet

+ Single sign-on from 3rd party Enterprise Portals
+ Inventory data and PDF reports

+ Secure encrypted link support (SSL)
+ Peering of locations
+ Authentication database synchronization

Customer location

Firewall (Optional)

+ Automatic firewall traversal
+ No firewall configuration needed
+ Fix IP address not required

Hub / FRI

+ Low power Intel Atom processor
+ Standard application server (Jetty)
+ Automatic software update support
+ Autonomous operation supporting full user experience with local access
+ Easy support for new devices
+ Continuous video recording server
+ Data storage (historical access)
+ Event logging
+ Automatic clock synchronization
+ Redundant hub support
+ Optional multiple uplink for redundancy
+ Optional built-in 3G support

Devices

+ Wired and/or wireless devices
  + Ethernet
  + Wi-Fi
  + IPv6 over IEEE 802.15.4
+ Zero configuration
+ Automatic security
+ Automatic provisioning
+ Automatic management
+ Device discovery using UPnP, mDNS, or 3rd party defined
+ Battery or external power

Removed

Reduce cost by technology innovation

2009
-60%

2013
-95%

Industry Praxis
- Configuration normally done manually.
- Minimal upgrades or modification over the life-span of the system.
- Installation and maintenance commonly much more expensive than the products.
- Minimal integration.

Yanzi Plug & Play v1.0
- Leverage Internet connection and cloud servers.
- Automatic provisioning of wired devices.
- Automatic software upgrades.
- Integrated view of all types of devices.
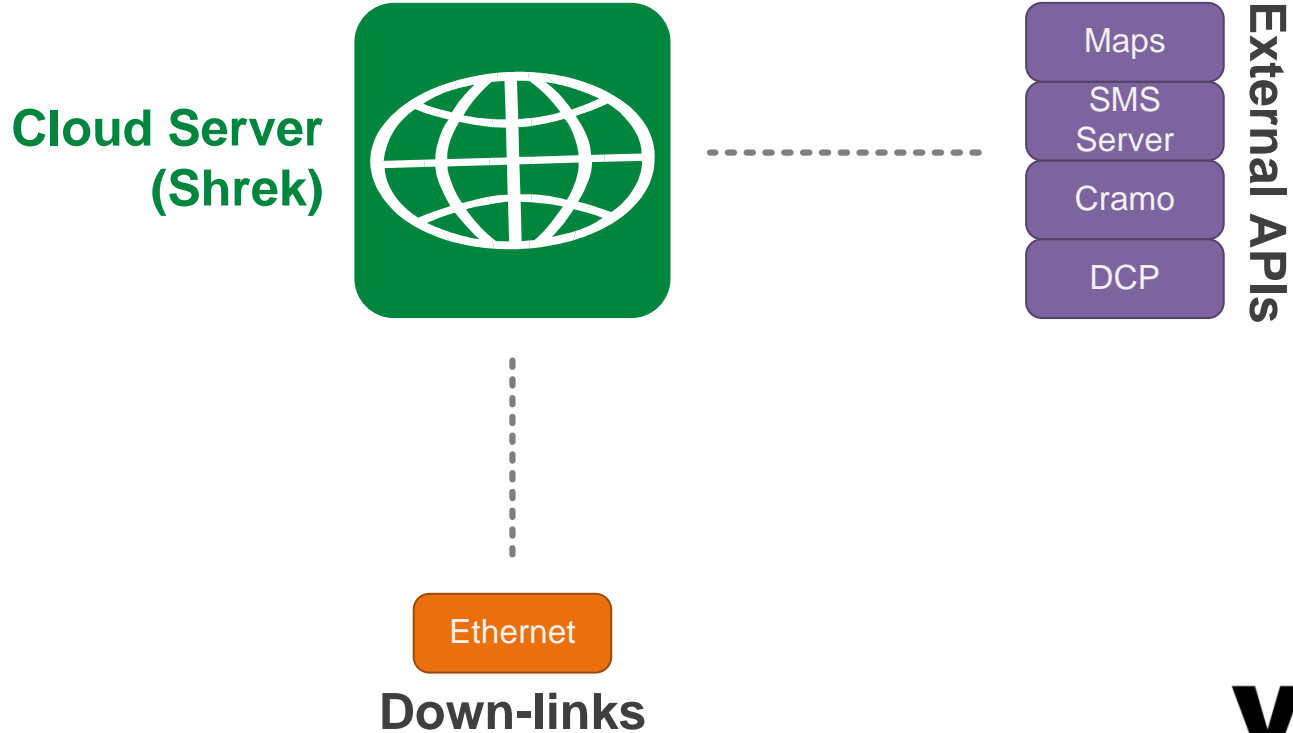- Simple to expand on demand.

Yanzi Plug & Play v2.0
- Automatic provisioning of wireless devices.
- Automatic security of all devices.
- Simple one click user interface for new wireless (or wired) devices.
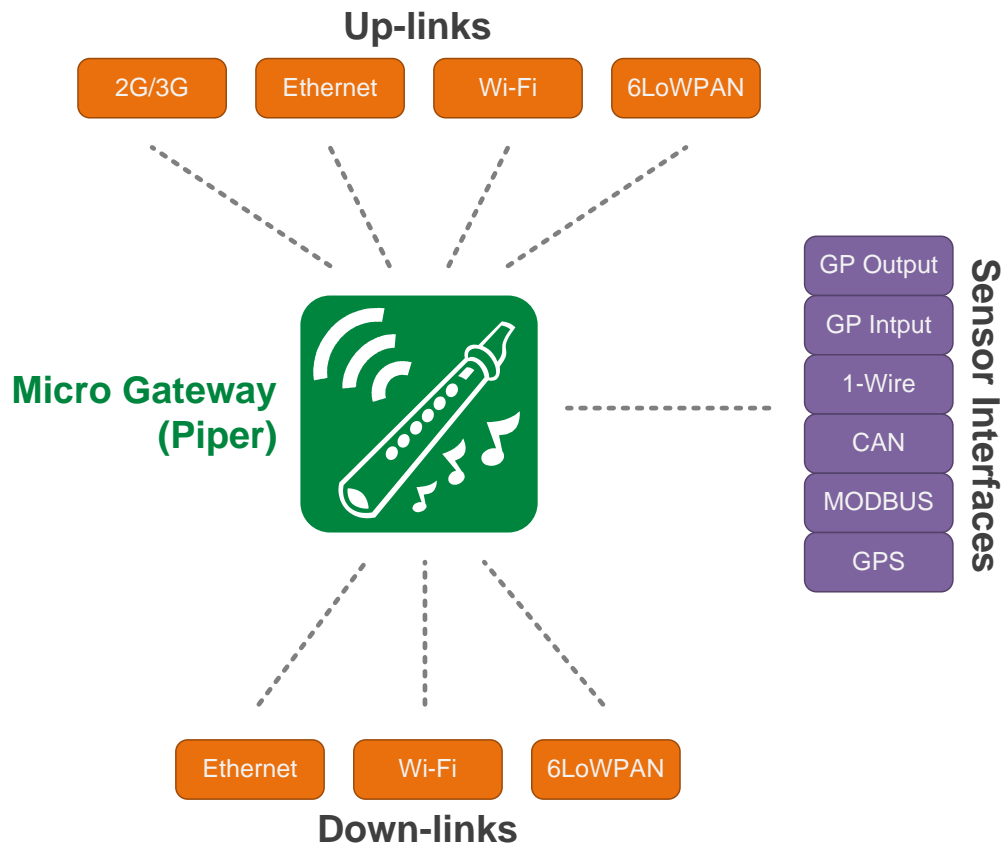
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- Separation of functionality

- Layered architecture

- Simple and standardized networking model
  - UPnP, DHCP, IP, HTTP, RTP, SSL

- Hardware abstraction layer in Java

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Cloud Servers

Cloud Server (Shrek)

Maps

SMS Server

Cramo

DCP

External APIs

Ethernet

Down-links

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Adapter

Up-links

| 2G/3G | Ethernet | Wi-Fi | 6LoWPAN |

Micro Gateway (Piper)

Sensor Interfaces

- GP Output
- GP Intput
- 1-Wire
- CAN
- MODBUS
- GPS

Interface	Application Examples
GP Output	Lamp, Heating, Gate
GP Input	Generic Alarm, Motion Detector, Door sensor, Push button
1-Wire	Temperature, Humidity, Digital In
CAN	Automotive, Lift, Engine
MODBUS	Energy Meter
GPS	Location service

| Ethernet | Wi-Fi | 6LoWPAN |

Down-links

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Applications –

Monitoring and Control

- Monitor temporary heating system during construction

- Energy monitoring and light control

- Temperature alarms
  - Detect open windows

- Equipment management
  - Temperature alarms on water return to detect equipment failure or air bubbles

- Incident recording using cameras

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End-to-End Service.

Yanzi delivers a complete solution from the sensor to the mobile.
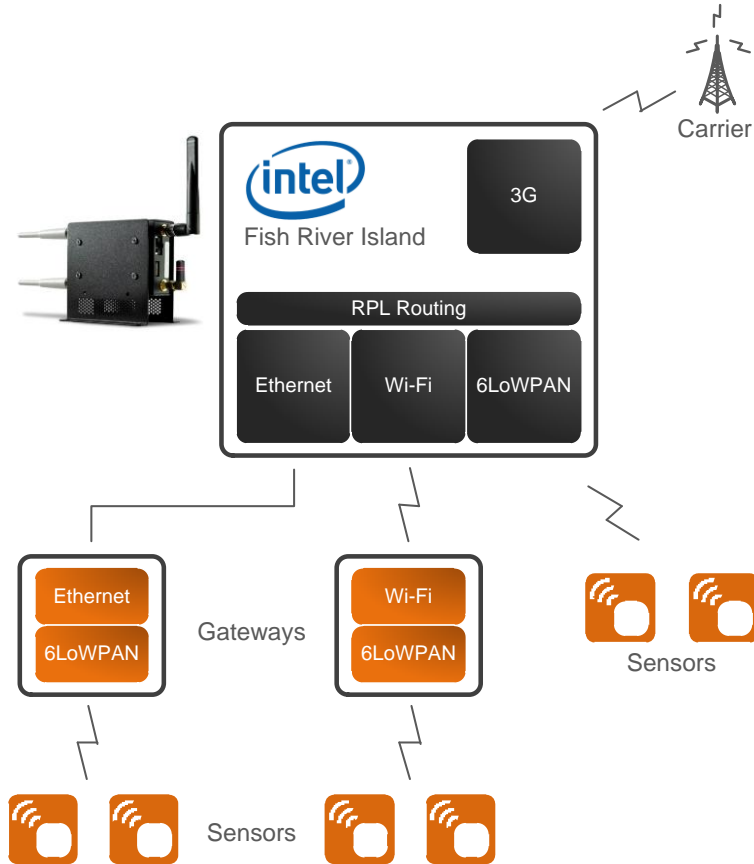
Key management

- Commutative cipher is used to distribute the local encryption key from the Hub to the sensor using the portal. Basically a Diffie-Hellman method.

- During provisioning phase, wireless routers need to communicate with new sensors unencrypted.
  - Pre-defined manufacturing keys
  - Customer need to accept new sensors
  - "WPA" or layer 2 key is automatically provisioned to sensors

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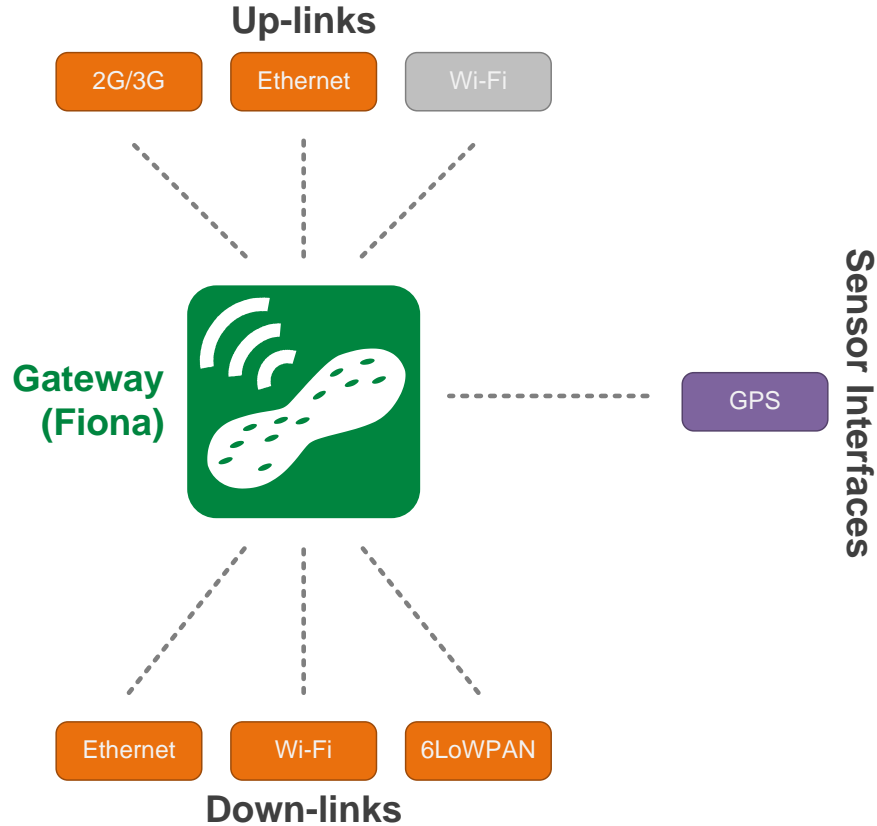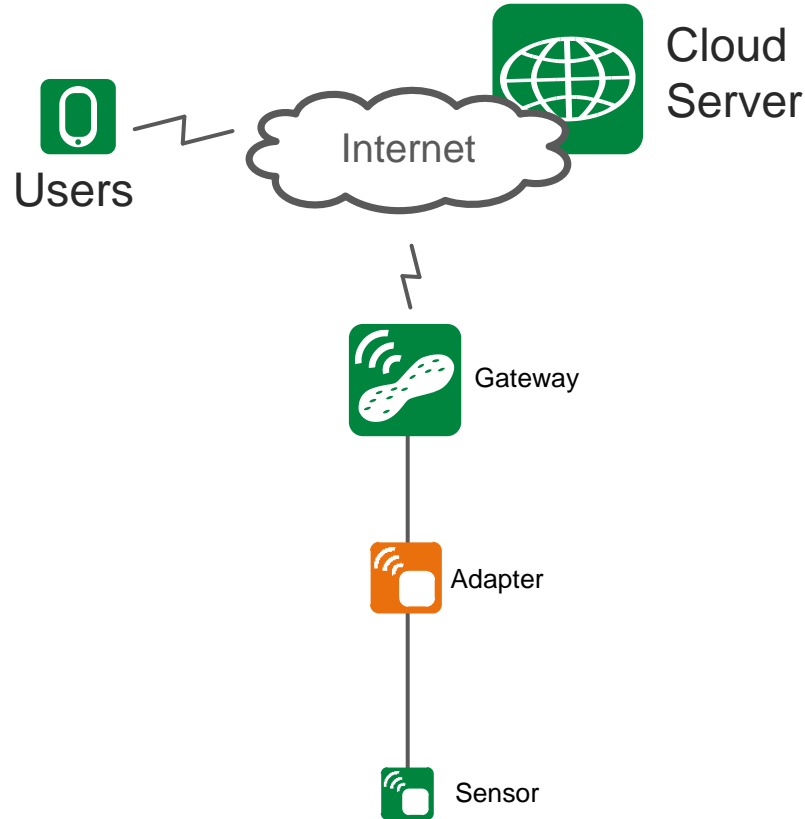networks

6LoWPAN and FRI

IoT

- Our number one enemy is complexity when we build a distributed IoT system.

- Complexity arise when heterogeneous systems are connected.
  - Error and management models may be different for different devices.

- Reduce strong dependencies between devices in order to provide a robust management model.

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Gateway

Up-links

| 2G/3G | Ethernet | Wi-Fi |

Gateway (Fiona)

GPS

Sensor Interfaces

Down-links

| Ethernet | Wi-Fi | 6LoWPAN |

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Simple Architecture

Scalable Provisioning

- Security
  - IP connectivity must always be automatically configured.
  - Security and authentication model must be robust and simple to operate.
  - Unique encryption keys for each sensor

1. Electrician installs batteries and sensors around a construction site.
2. Two weeks later, the gateway with 3G connection is installed.

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