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Project facts
DAIAD is an FP7 project

- Full title: Open Water Management – from droplets of participation to streams of knowledge
- Instrument: STReP
- Objective: ICT-2013.6.3 ICT for water resources management
- GA: 619186
- Duration: 42m (3/2014–8/2017)
Member of the ICT for Water Cluster.

- **SmartH2O**: Social computing for efficient management of water consumption
- **DAIAD**: Real-time water monitoring and big water data analysis
- **iWidget**: Integrated supply-demand management
- **WatERP**: Optimize water/energy use across water supply
- **ICEWater**: SWM management, DSS and demand management
- **UrbanWater**: Cloud system for water management
- **ISS-Ewatus**: Integrated support system for water usage
- **Waternomics**: Conservation awareness and leak detection
- **EFFINET**: Operational control, real-time monitoring, demand management
- **WISDOM**: Real-time water monitoring and big water data analysis
Consortium assembled on excellence, multi-disciplinarity, and balanced participation of RTD, SMEs and water stakeholders

**Athena** is an RTD organization and ICT integrator focused on diverse data-intensive research (*Coordinator*)

**Bamberg** has multi-disciplinary research and applied experience in interventions for resource consumption

**Amphiro** is a unique SME with domestic water monitoring products

**Fraunhofer ISI** has theoretical and practical experience in water demand modeling and sustainability

**Waterwise** is a leader on social empowerment for water preservation

**AMAEM** is a water utility with heightened water management challenges
Water challenges
Let us introduce you to water
70% water
save water!
save live!
DROP BY DROP
Ναϊάδες
naiads
The human right to water entitles everyone to sufficient, safe, acceptable, physically acceptable and affordable water for personal and domestic uses.
SUCCESS!
NO.
Salt water 97.5%
Fresh water 2.5%

In glaciers 1.717%
On Earth's surface 0.008%
Frozen 0.025%
In ground 0.750%
Localized

Ground Water Storage

Wetness Percentile

acquired September 17.
YOU'RE GONNA MISS ME WHEN I'M GONE...
HOWEVER...

1 IN 10 OF WORLD'S POPULATION DON'T HAVE ACCESS TO SAFE WATER

1 IN 3 OF THE WORLD'S POPULATION DON'T HAVE ACCESS TO ADEQUATE SANITATION
By 2025, there will also be 1 billion more mouths to feed, requiring an additional 1 trillion cubic meters of water for agriculture alone.

= 50 billion Cubic Meters of Water

- 70% Irrigation
- 22% Industry
- 8% Domestic Use
This will lead to 1.8 Billion People living with absolute water scarcity & 2/3 of the world’s population in stress conditions from water shortage.
Annual Water Withdrawals Per Person by Country

Cubic Meters a Year

- less than 100
- 250 - 500
- 500 - 1000
- 1000+
By 2025, Everyone Will Feel the Impact

- = severely more stressed (2-2.8x)
- = extremely more stressed (2.8-8x)
- = exceptionally more stressed (>8x)
By 2050 almost 1.4 billion people will lack sanitation if demand continues to rise.

Farming and improper waste treatment would pollute major bodies of water (rivers, ground water, oceans).

Concurrently, a lack of freshwater for agriculture will impact the food supply.

Flooding and droughts may increase as the climate adjusts.

Political unrest and crime could rise as quality of life declines and trade countries may demur from investing in such unstable economies.

Wars may result as the situation grows more desperate.
WHAT CAN I DO?!!
KEEP CALM AND Save The Water
Do you know how much water you use?
I am average! Do I need to change?

> 50% self-identified as “average” water user

1/3 self-identified as “low” water user
No idea about actual water use

Figure 2: Responses on "how much water do you consume every day? (in liters)"
Do you know how much water it takes to:
It takes...

10 liters of water to make one sheet of PAPER

40 liters of water to make one slice of BREAD

70 liters of water to make one APPLE

80 liters of water per dollar of INDUSTRIAL PRODUCT

91 liters of water to make half a kilogram of PLASTIC

120 liters of water to make one glass of WINE

140 liters of water to make one cup of COFFEE

1,300 liters of water to make one kilogram of WHEAT

4,800 liters of water to make one kilogram of PORK

10,855 liters of water to make one pair of JEANS

15,500 liters of water to make one kilogram of BEEF

16,600 liters of water to make one kilogram of LEATHER
We consider water as a perishable resource. Why?
Water is cheap and rightly so!
The human right to water entitles everyone to sufficient, safe, acceptable, physically acceptable and affordable water for personal and domestic uses.
No pricing incentives
50% of EUs domestic water is not metered
sporadic water bills
We have no stimuli and incentives to change our behavior.
2.7-22% reduction in fuel consumption
26.9% increase in physical activity
Motivation is what gets you started. Habit is what keeps you going.

-Jim Rohn
Got it!
So we need stimuli to change our water use
In your face grumpy cat!
NO.
Single
Engaged
Divorced
Separated
In a Relationship
Married

It’s Complicated
In order to provide effective stimuli to consumers, we need data.
But we do not have the necessary data. Why?
Water meters are not enough — total consumption every few days/months
Example: someone in the car did not wear a seatbelt last week
OK, so why not get better data from water meters?

Well...
Frequent, highly granular, accurate, non-aggregated, real-time
No thanks, I am just fine!
Money? Now?! ?
Huh?
So, to provide stimuli that affects consumer behavior and leads to self-induced changes in water use, as well as financial benefits for all, we must first provide better quality water consumption data. But the water meters we have cannot provide the data we need. The cost to improve them and provide data with better granularity and frequency timely provided where and when water is used, is simply too great for them, and with a questionable return on investment. Water utilities are perfectly happy with how they measure and bill water consumption, so why change? The public sector alone cannot also handle the costs.
(*) What Would Alexander the Great Do?
Empower Consumers!
Motivation
Let’s see how we monitor consumption for electricity.

Smart meters with highly granular data, low-cost off the self monitoring devices, multiple services to convey knowledge, integrated in smart homes and mobile devices
Motivation

How about water?

Aggregated data every few months, single point metering, no personal monitoring, paper bills and reports, stagnant stakeholders

"if it ain't broke, don't fix it."
Motivation

Electricity & Water do not mix
Is the smart water meter enough?

Smart water meters (SWM) are complementary but not enough; they cover single point metering but not monitoring.

- How do I measure hot water consumption? [energy]
- How do I measure consumption at the point of use? [stimuli, types]
- Is ‘real-time’ truly real-time? [latency, detail]
- How are data transmitted to end-user interfaces? [stimuli]
- Who pays for the SWM? [shared-investments? ROI?]
Motivation

We don’t have detailed water consumption data, nor the means to exploit it.

Water Demand Management is based on highly aggregated data and crude assumptions providing limited insights (who, when, where, why, what).

Interventions and stimuli for water consumption still paper-based and at best electronic versions of highly aggregated information.
Motivation

We need the data first!

- Create real-time and detailed water consumption data
- Devise means to manage and extract knowledge
- Create interventions and stimuli that exploit this knowledge
- Apply new data and insights in WDM

Welcome to DAIAD
The DAIAD approach
Who is DAIAD?

**Naiads**
- In Greek mythology, **Naiads** were nymphs that presided over fountains, wells, springs, and other bodies of freshwater.
- Each Naiad protected a specific fresh water source, e.g. Limnades (for lakes) and Potameides (for rivers).

**Data + Naiad = Daiad!**
- A new type of fresh water nymph, called Daiad, which symbolizes the project’s objectives.
- Daiad presides in all residential water sources, monitoring every drop of water, guiding humans towards a water saving culture, and ensuring that water is well used.
The DAIAD approach

Our idea

- Decouple metering from monitoring
- Consumers self-adopt low-cost water monitoring
- Harness this data and knowledge for stakeholders
- Make consumers the foundation for sustainable changes in water use

Empower Consumers
Consumer Benefits

- Emphasis on the shower (2nd largest energy use)
- Cost savings from water use (22%)
- Cost savings from hot water use (440 kWh/year)
- Maybe CO2 credits (work in progress)

Pays itself in a few months!
Our objectives

- Develop low cost real-time, multi-point water consumption monitoring
- Research consumer-oriented and intuitive knowledge delivery mediums
- Research and develop big data management for large scale, real-time water consumption data
- Devise and support novel resource/demand management strategies, including corresponding pricing and incentive schemes
- Perform extensive and in depth real life user trials
The DAIAD System

FEEL

HOME

COMMONS

UTILITY

KNOW
The DAIAD System

Low cost, real-time water monitoring

DAIAD @ feel will provide the missing real-time water consumption data. You simply install it in a water faucet once, no power needed. Just use water as you normally do and get instant data!
The DAIAD System

**DAIAD@home** will convert water consumption data to knowledge for consumers and utilities. A simple piece of software, install once and forget!

**Consumer analysis and recommendation services**
The DAIAD System

**Manage and analyse water consumption for groups**

DAIAD@commons will empower consumers through social innovation towards sustainability.

Share your water consumption data with others, form a community, and gain insights together.
The DAIAD System

Manage and analyse water consumption for WDM and stakeholders

**DAIAD@utility** will enable the application of real-time water consumption data towards novel Water Demand Management strategies. Use highly-granular water consumption data to overhaul water management and pricing.
DAIAD@know will convey knowledge to consumers to induce behavioral change. Mobile phone, tablet, or a web application? Pick your favorite and get insights on your water consumption.
Early DAIAD integrated system ready!

- End to end data flow: sense, transmit, store, view
- Mobile apps (iOS, Android)
- Commercially available by July 2015
- Portable aquarium to showcase the prototypes

Demo in a few minutes
DAIAD prototype
The DAIAD approach

amphiro a1

Energy-autarkic water sensor
Self-installed in shower
Integrated LCD for real-time in situ interventions
ETHZ spin-off
Energy-autarkic (no batteries!)
Prototype Development

- Simultaneous and collaborative effort in Athens, Bamberg, and Zurich
- Micro-generator (increase output)
- BT4.0 integration
- Rapid prototyping (Arduino)
- BT4.0 APIs
Year 1

Prototype Development
 Prototype Development
amphiro b1

Increased energy harvesting to power RF
Better accuracy (±5% at 12 l/min)
Programmable LCD for real-time in situ interventions
Open BT API
Influencing water use (determinants)

- Our resource consumption is affected by pricing and non-pricing determinants
  - Pricing: obvious!
  - Non-pricing: age, income, location, weather..
- Our resource consumption is also split to elastic and inelastic
  - Inelastic is the absolute minimum (e.g. drink water, sanitation)
- Our goal is to enable consumers to self-induce changes in their water use!
- How?
Year 1

Interventions
Year 1

Interventions

1. Current/real-time/in-situ feedback systems

2. Historical/analytical feedback systems

3. Psychological nudges/Comparison features
If you keep your water behaviour, by the end of 2015, you'll save 45 euros.

Lake Plastira, Greece would return to its safe level.
Water as BIG DATA
Cloud ready!

- Cloud infrastructure in place (IaaS) (Synnefo/Ganneti)
- VMs available, SW deployed, early benchmarking/results
- 64 cores/ 192GB mem/ 10TB storage
- Will be part of HELIX PaaS/SaaS (Greek Research Data Infrastructure)
Year 1

Early Crowdfunding Campaign

Test the waters and seek funding for mass Amphiro b1 production (BT enabled)
Successfully raised 30K and gained worldwide exposure for the project
User Trials (12 months)

- Alicante, Spain
  - Simulates deployment by a water utility (top-down)
  - Deploy DAIAD, provide support to consumers
  - Access to 60K smart water meters (early data, compare accuracy, integrate in analysis)

- St. Albans, UK
  - Simulates uptake by a consumers (bottom-up)
  - Hand out equipment and provide electronic-only support through social channels
  - Evaluates social impact, community engagement and dynamics towards water saving
The DAIAD approach

DAIAD is an Open Knowledge project

- All software provided with an open source license (github.com/DAIAD)
- All deliverables and content provided with a Creative Commons Attribution license
- All data generated provided with an Open Database License (see labs.publicamundi.eu)

Be a part of DAIAD!
The DAIAD approach

Be a part of DAIAD

In DAIAD we believe in open innovation and participation as the critical means to improve how we monitor, understand, and use water

Join us!
Thank you!