Living PlanIT at Cisco C-scape

July 2011 – Version 1

IMPROVING QUALITY OF LIFE THROUGH TECHNOLOGY

Living PlanIT

Overview

Living PlanIT is a technology company focussed on delivering platforms which accelerate and optimize the delivery of Future Cities. Deployed in association with an extensive partner ecosystem, developers, building owners, and service providers use these platforms to envisage, design, manufacture, assemble, operate, service, maintain, and decommission buildings more efficiently, improving performance in terms of environmental, economic, and social sustainability.

Additionally, the smart infrastructure deployed in these developments – specifically the Urban Operating System or UOS™ provides a platform for both economic growth and for adding capabilities to these cities on an ongoing basis through the development of value-add applications.

Living PlanIT has its largest concentration of human resources at its base in Portugal, but has staff located also in the UK and the US. Living PlanIT currently employs just over 100 people and will accelerate growth in the second half of 2011.

Projects

Living PlanIT is at various stages of discussion with multiple cities and developments worldwide through both developers and governmental bodies, but three projects have been announced to date:

- PlanIT Valley, Paredes, Portugal (led by Living PlanIT)
- Wembley (led by Quintain, a Living PlanIT Property Development partner)
- Greenwich Peninsula (led by Quintain)

Living PlanIT is also in discussion with several parties with regard to deploying certain aspects of its technology at more limited scale, in most cases focussed on either energy or retail solutions.

Partners

Living PlanIT has over 1000 partners in its current pipeline and is closing on average 10 new partner deals a month with this rate increasing. Notable partners include Cisco, Microsoft, McLaren Electronics, Buro Happold, Gehry Technologies, Philips Lighting Systems, Fibersensing, University of Porto, and Ecotech. Living PlanIT promotes a partner-driven delivery model, for example:

- With the exception of PlanIT Valley, Living PlanIT does not intend to be a real estate developer
- Living PlanIT has no plans to enter the sensor manufacturing business
- Living PlanIT in general does not intend to build the applications for future cities – just the application platform.

While in PlanIT Valley Living PlanIT will act the role of the primary developer, this is purely to create the 'prototype' under Living PlanIT control. Subsequent developments will be carried out by real estate developers and their partners who elect to partner with Living PlanIT. PlanIT Valley – together with the initial projects with development partner Quintain – provide an opportunity for new techniques to be learned and optimized before partners use them on their own projects.

PlanIT Valley

PlanIT Valley will be built on 17 square kilometres of land in the municipality of Paredes, Portugal, which is near Porto, Portugal's second largest city. PlanIT Valley is intended to provide a proving ground, demonstration facility, and living laboratory for Living PlanIT and its partners to continue to build subsequent generations of smart urban technology. Technologies and approaches proven at scale in PlanIT Valley can be replicated elsewhere.

The first wave of PlanIT Valley will provide homes for around 10,000 people, and is expected to start construction in 1Q12, with land acquisition currently under way. Ultimate capacity is expected to be in the region of 230,000 inhabitants.

Greenwich Peninsula

Living PlanIT technologies will also be deployed at scale in the next few buildings to be erected at Greenwich Peninsula (near the O2 arena), a major urban regeneration project being conducted by Quintain in partnership with Bovis LendLease. Residential and mixed use buildings will start construction in 1Q12 and planning using Living PlanIT's Urban Lifecycle Management methodology is underway.

Technologies

Our products and services are organized around the concept of Urban Lifecycle Management – that is addressing the entire lifecycle of a set of buildings and infrastructure from envisioning through to decommissioning.

The lifecycle is enabled for our customers through three product lines:

- Plan & design - The Urban Design Workbench : UDW™
- Build - The Urban Trading Platform: UTP™
- Operate & Maintain -The Urban Operating System : UOS™

By lowering the cost of designing and constructing buildings through the UDW™ and UTP™, any incremental costs associated with the integration of a rich technology platform can be more than offset. This in turn enables an integrated platform - the UOS - for building and infrastructure control, which further drives efficiency through improved operations and continuous improvement based on analysis of performance data. This in turn provides a platform which can be used to support economic growth, further innovation and additional revenue for participants through the development and delivery of value-add applications built on the UOS API.

Urban Design Workbench (UDW™)

The Urban Design Workbench (UDW™), based in part on earlier work by Gehry Technologies, supports a design-centric development process in which detailed models of buildings and infrastructure are built from libraries of modular components available in the partner ecosystem. These models are extensively simulated in terms of building performance and the manufacturing process in order to optimize both. In particular, the interaction between building physics and control models can be fine tuned before any construction even begins.

The model is maintained throughout the life of the building, providing efficiencies any time modifications are required, faults need to be rectified, or maintenance planned and carried out. Ultimately the model can be used for building decommissioning, with removed parts being recycled, refurbished, or even reused as is based on detailed knowledge of the part derived from the original model and its lifetime conditions via the UOS™.

Urban Trading Platform (UTP™)

The Urban Trading Platform (UTP™) leverages existing online marketplace solutions and supply chains to create a cloud-based environment for component procurement, contract and project management, and supply chain and logistics management. UTP™ takes the manufacturing plan provided by the UDW™ and allows a developer to source the Bill of Material, with explosion out to all supply chain levels. This in turn can be used to create an overall plan for the project, and to coordinate logistics for maximal efficiency and reliability across all components.

UTP™ can also be used to meet the ongoing procurement and logistics needs of a future city development. In PlanIT Valley, integrated logistics and warehousing hubs will be fed by the UTP™ partner ecosystem, and the UTP™ used as an enabler for both wholesale and online retail purchasing.

Urban Operating System (UOS™)

Living PlanIT's Urban Operating System (UOS) provides a unified platform for the instrumentation, control, and optimization of urban environments, based on Cisco network and data center hardware. UOS software allows a Cisco ISR router to supplant traditional building controllers, which are normally single-purpose devices. The building benefits from a shared infrastructure that supports deep sensing, responsive real-time control, and high-speed flexible networking.

A wide range of sensors and actuators, supplied by Living PlanIT and Cisco partners, communicate over IPv6 and allow a complete picture of building state, usage, and operations to be continually maintained, allowing constant optimization of energy, resources, environment, and occupant support and convenience systems. The UOS provides near-real-time communication of events across an entire city and beyond, meeting multi-level control needs via applications such as energy generation / storage / distribution / demand shaping and traffic and transportation management.

The UOS provides a rich set of application services which support 'PlaceApps' - applications that are context-sensitive - including location - and can be experienced via a wide range of devices. PlaceApps can be thought of as the urban environment equivalent of an iPhone app. The UOS makes building such applications easy and ensures that applications only have access to data and control capabilities that they should have, depending on the user.

The UOS and sensor network is deployed as a set of 'appliances' based on Cisco technology that are integrated into the structure of a building - in most cases through incorporation into modular building components. These are supported with sophisticated simulation modeling techniques that are incorporated into advanced product lifecycle design and management tools used to design buildings and infrastructure and which help size and locate the appliances appropriately.

The first of these appliances is the 'Urban Network Appliance' – a Cisco Integrated Services Router or ISR, equipped with a service module and running UOS Real Time Control code developed from McLaren Electronics ECU software. By abstracting edge services - sensing and actuation control, edge analytics and real time performance improvements and providing a rich flow of content to the UOS, we enable the richest granularity for advanced analytics while distributing network and processing loads.

The second of these is the 'Urban Cloud Appliance' – an implementation of Cisco's Unified Compute System platform (UCS) which runs the Urban Operating System as well as other network shared services deployed through the urban development.

Overall this standardization of a shared platform provides significant cost savings and and also ensures implementation consistency, quality and manageability. This method of enabling building measurement and control allows for the collection of large quantities of coherent data which enables all aspects of building function to be measured and improved continually through the lifecycle of the building, and also learnings to be applied to subsequent building construction. In addition, the common platform enables a vast array of improved capabilities and experiences to be unlocked via PlaceApps, providing improved sustainability in economic, social, and environmental domains, as well as new levels of safety, security, building protection, building management, and operator and tenant convenience. Additionally, this ground breaking platform helps to harmonize building physics with materials, usage, and control algorithms, while providing the infrastructure and service layers for a whole new range of value add.

No company can or should hope to deliver all of this on their own, so together with Cisco the implementation model is partner driven, with partners fulfilling roles from building construction through building components through sensors through application development. This provides increased opportunity and value for the Cisco partner channel, and also provides an excellent basis by which the software development world can leverage smart city fabric, stimulating new businesses and new forms of urban interaction. This can be thought of as creating "iBuildings", or even an "iCity".

Living PlanIT UOS™ Demonstration at Cisco C-span, July 2011

At C-span we will be showing sample applications running on a compact version of the entire UOS™ architecture covering the following scenarios:

- Building Monitoring & Escape
- Remote Biometric Sensing
- Traffic Management
- Water Control

These demos all run on an entry-level Living PlanIT Urban Cloud Appliance built on a Cisco 2951 ISR.

Discussing each briefly in turn:

Building Monitoring & Escape

In this scenario, a virtual building is monitored for temperature and structural strain, represented in the demo by fiber-optic based sensors supplied by Fibersensing. As we warm the sensor, the ambient temperature in the location represented by the sensor increases rapidly. The pattern and degree of heat increase – together with other sensor inputs not represented in the demo such as cameras, smoke and chemical detectors – causes the UOS™ to forward information to safety and security applications together with alerts to the city monitoring center. An automated evacuation alert is triggered at a critical temperature. At this point, directional sirens sound in the building, and the smart LED light boxes – which normally provide the correct level and color temperature of illumination based on conditions – switch to evacuation mode, running if necessary off battery backup power. In evacuation mode the lights show occupants in every part of the building the safest escape route, taking into account the location of the hazard and the numbers of people using each route.

We reset the system to show how the UOS™ responds to another issue. This time, a structural member in the building is showing strain levels greater than nominal. This sends an alert to an engineer in the city monitoring center to have someone look into what is going on. However, once the level of strain exceeds a critical threshold an evacuation is again triggered. The light box in this case shows a different route due to the problem being differently located, and indicates a different class of problem through color. It should be noted that in general most buildings are not continuously monitored for strain and therefore often structural failure occurs before inhabitants can be warned.

Remote Biometric Sensing

This demonstration shows how the UOS™ can obtain information about the medical condition of individuals who may be considered at risk for a number of reasons – patients in medical facilities, those needing assisted living, or those away from home who have a higher than usual risk. The provision of such monitoring can be simplified by the UOS™ infrastructure, with multiple different information sources integrated continually to build up the most comprehensive picture of the state of the individual concerned. Monitoring can be provided continually independent of location and without requiring specialized equipment in the rooms where monitoring occurs.

To emphasize this point, one of our presenters is wearing a Biodevices Vitaljacket which wirelessly communicates EKG readings to the UOS. The EKG readings can be seen to vary when the presenter exerts himself. This data is continually logged, analysed, and can be reviewed by a physician remotely at any time. The Biodevices jacket also records the orientation of the individual via a miniature gyrosensor – this can be used to help interpret the EKG readings and also to detect when, for example, an elderly person has fallen or lost consciousness in his or her home.

Traffic Management

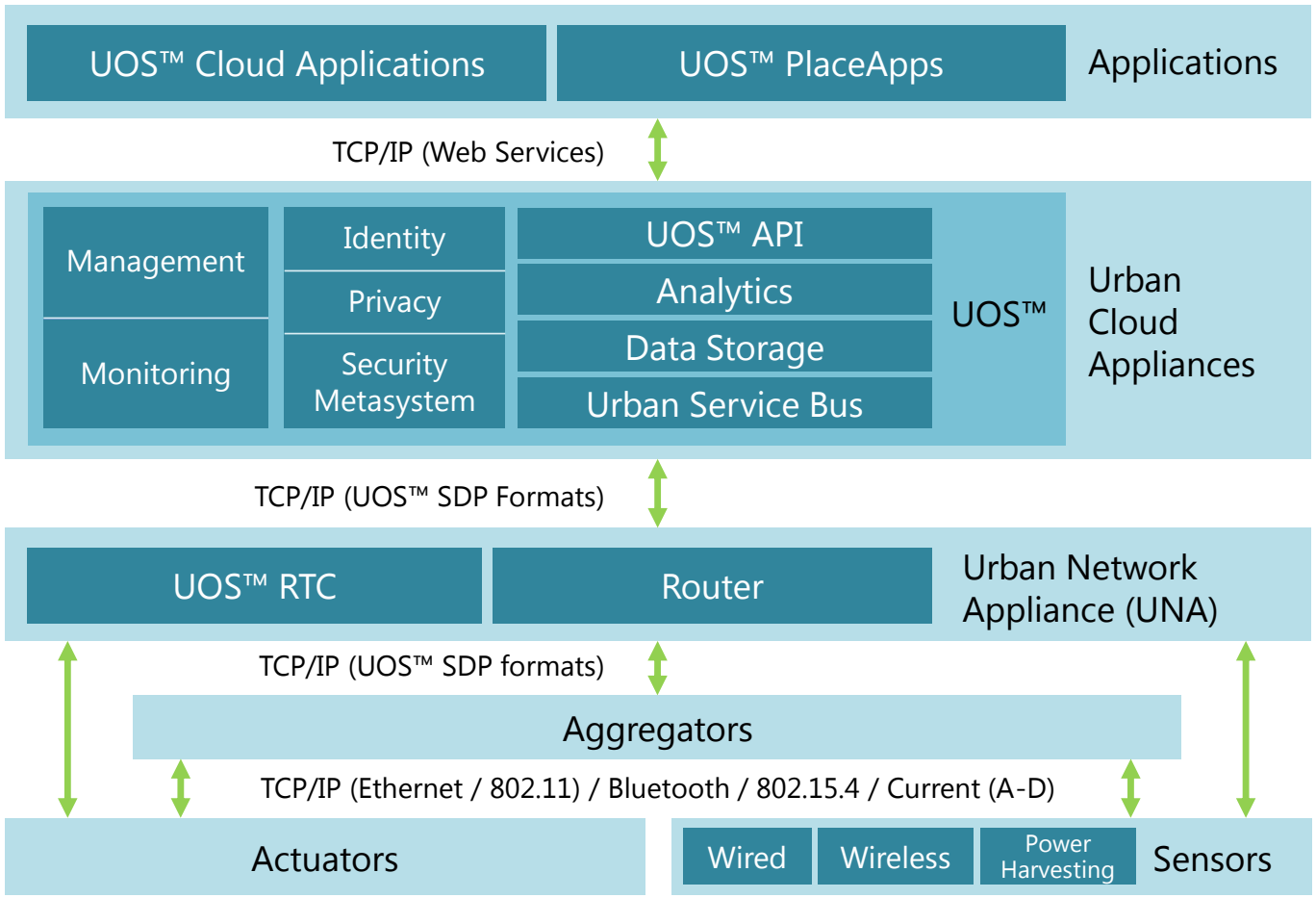
This shows how traffic can be managed in a future city. Individual vehicles all report their location, speed, and where known, intention (for example from navigation systems or driver regular patterns) to each other and to the city traffic management systems. This allows the flow of traffic to be optimized – load balanced if you like – across the entire city. In this instance a smart traffic management solution is implemented using the UOS™ in conjunction with a distributed traffic solution developed by Geolink and Virtual Traffic Lights (and based on earlier work by the University of Porto and Instituto de Telecommunicacoes). In this solution, traffic lights are eliminated with instructions being given to individual vehicles continually by the UOS™ and by interactions with other vehicles. Since we can't mess with real traffic, the demonstration shows an advanced simulation of real traffic behavior in the city of Porto obtained by monitoring real-world traffic over an extended period of time – and incidentally shows improved traffic flow compared to traditional systems. Due to an accident, the UOS™ needs to clear an expedited path for an emergency vehicle responding to the scene. Once the instruction is sent, a window in time and space is cleared for the emergency vehicle, which therefore can provide aid in the minimum amount of time. Other traffic is routed away from this window, which has a short term impact on the other traffic, but in most cases this is minimal. The demonstration shows the advanced coordination capable in a fully instrumented and integrated city.

Water Control

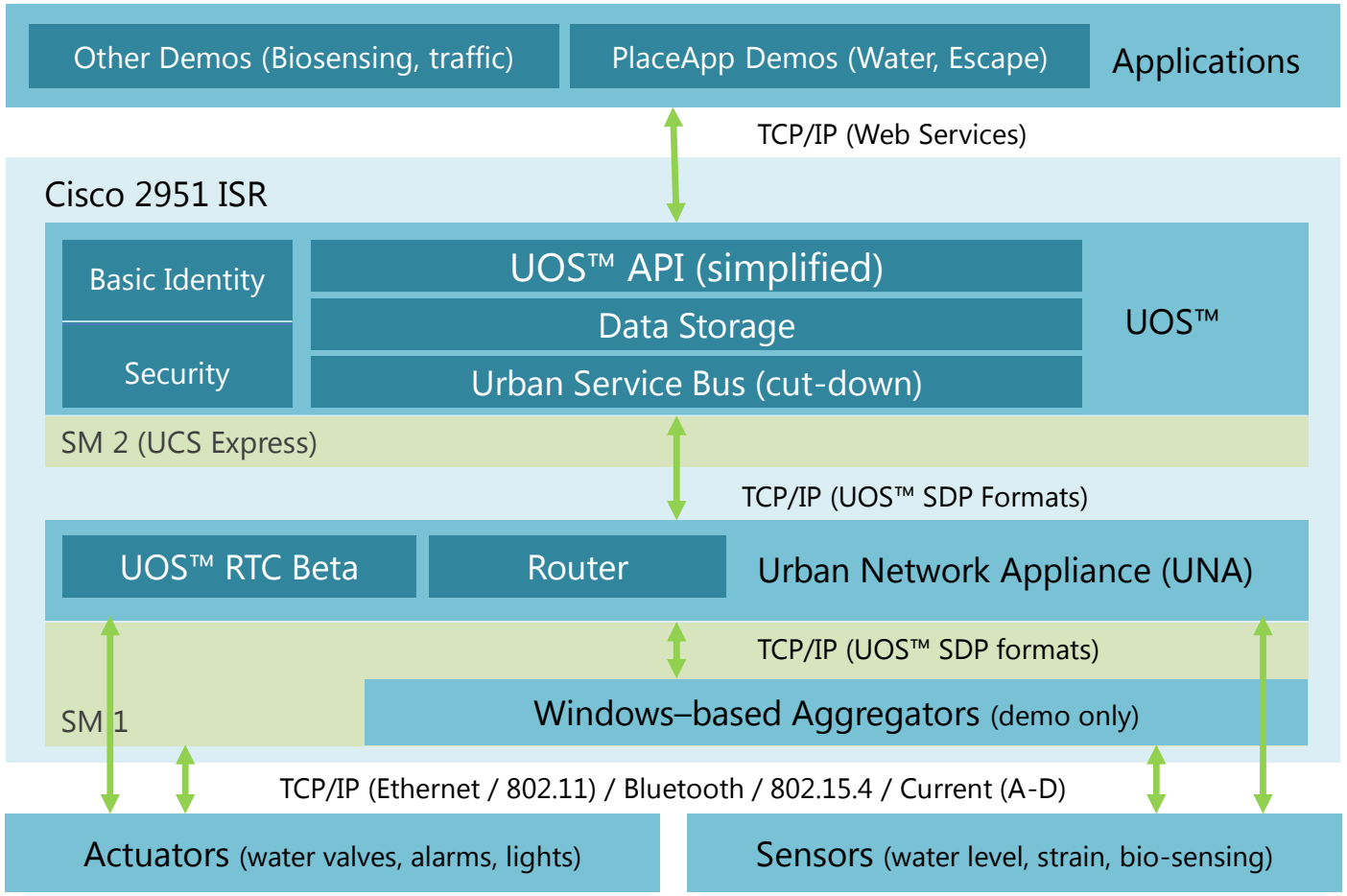
This demonstration shows the benefits of automating even simple functions such as controlling taps and waste in a bathtub or basin. Firstly, this provides resident convenience, as perfect baths to individual's requirements can be poured easily from a number of interfaces including wall panels and iPhones. Secondly, this minimizes wasted heat and water and therefore is a significant contribution to sustainability as pre-warming of the water by running the tap can mostly be avoided. Thirdly, this is a safety feature – children and the elderly can be badly injured by hot water, here, cold water is always poured first to virtually eliminate this risk. Finally, this also helps protect the building, as neither leaving taps on nor unintended displacement can cause water to escape onto the floor, with consequent clean up and damage remediation costs.

The demo stand provides a miniature emulation of a bath. It can be seen that the bath can be filled by profile to different requirements from both a wall-mounted screen and an iPhone app. The profiles differ with a child's bath being notably shallower and cooler than that for an adult. Additionally, additional displacement is countered by the waste rapidly opening and purging excess water.

UOS™ high-level architecture



Architecture of UOS™ demonstration



Ecosystem Partners involved in Demonstration

CISCO

Microsoft

McLaren
ELECTRONIC SYSTEMS

PHILIPS
sense and simplicity

FiberSensing
bringing light to measurement

libelium
comunicaciones inalámbricas distribuidas

GEOLink

VIRTUAL TRAFFIC LIGHTS

biodevices

U.PORTO

instituto de telecomunicações

ieeta

universidade de aveiro
theoria poiesis praxis

optimus

Partner Technologies Featured

- Cisco 2951 Router and Service Modules supplied by Cisco
- Windows Azure and Visual Studio 2010 supplied by Microsoft
- UOS RTC based on content developed by McLaren Electronics
- Light Box supplied by Philips Lighting Systems (The Netherlands / US)
- Fiber Optic Sensors supplied by Fibersensing SA (Portugal)
- Zigbee Sensors supplied by Libellium (Spain)
- Vitaljacket supplied by Biodevices SA (Portugal)
- Traffic simulation based on content developed by:
  - Geolink (Portugal)
  - Virtual Traffic Lights (Portugal / US)
  - Universidade do Porto (Portugal)
  - Instituto de Telecomunicações (Portugal)
- Thanks to all our partners shown above, and also to:
  - IEETA / Universidade de Aveiro (Portugal)
  - Optimus (Portugal)