

# Liquid Net

Powered by Nokia Siemens Networks

Nokia Siemens  
Networks



Tapping into the  
future of broadband



# Networks with fluid capacity

Liquid Net unleashes frozen network capacity into a reservoir of resources that can flow to fulfill unpredictable demand, wherever and whenever people use broadband

Like a supermarket shelf of mineral water, the coverage, capacity and services in today's networks are bottled up – frozen in individual radio cells, in separate core applications and stuck on transport layers. Not only does this create capacity bottlenecks, but it hampers the ability of communications service providers (CSPs) to deliver broadband capacity to the right place at the right time to satisfy customer demand.

Nokia Siemens Networks' Liquid Net breaks these conventional network capacity and resource limitations, achieving more flexibility, higher efficiency, lower costs and a superior customer experience. Liquid Net creates networks that can adapt in an instant to changing customer needs, using existing capital investments more efficiently and generating entirely new revenue sources for CSPs.

## Superior customer experience

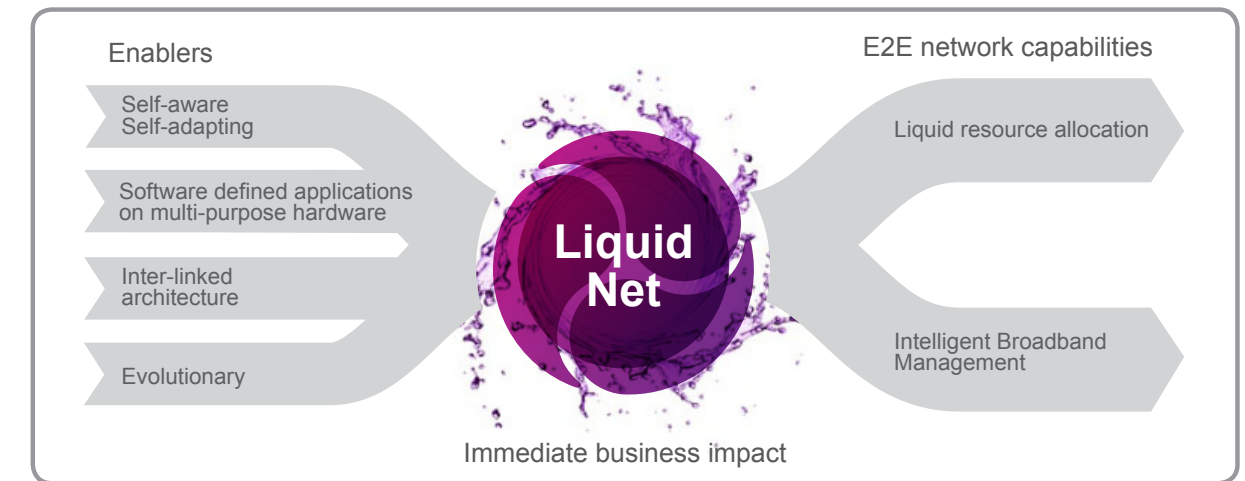
Liquid Net enables CSPs to deliver the capacity, coverage and services needed to provide the best broadband experience for users wherever they go and whatever they need, generating customer loyalty and opening up new ways to create additional revenues.

The network uses its flexibility to maintain a high level of user experience by responding to traffic peaks caused by such things as new applications or short-lived events and incidents. And this dynamic capability is matched by a transport infrastructure that intelligently and flexibly connects users to the service, content or application they want.



## Four key enablers to making networks more fluid

- Self-aware, self-adapting: The network recognizes where demand is coming from and instantly re-adjusts itself to deliver the right capacity, coverage and services to the right places.
- Software-defined applications on multi-purpose hardware: Software-defined network applications run on multi-purpose hardware, either COTS ATCA-based or other generic, enabling processing capacity to be matched to changing demand.
- Inter-linked architecture: Infrastructure elements are extensively inter-connected to allow capacity and processing to flow freely across the network.
- Investment-protection, evolution: Liquid Net takes a fully evolutionary approach that is non-disruptive, yet also transformational.



## Lowest cost delivery

Liquid Net implements fluid capabilities seamlessly and intelligently across the entire network infrastructure, not just in radio access or core network components. This realizes the full potential of reflowing functionality to meet subscriber demands as efficiently and cost-effectively as possible.

The network's capital efficiency is enhanced. Huge chunks of unused network resources, as much as 80% of baseband capacity, can be released by avoiding the need to

dimension every network element according to peak demand. In the core domain, the network element footprint can be reduced by 80% and energy use cut by up to 65%.

Liquid Net builds on the principles of Nokia Siemens Networks' Liquid Radio architecture. It adds Liquid Core and Liquid Transport functionality to the network which can be implemented either separately in multi-vendor environments or in concert across a CSP's entire network to bring the full benefits of Liquid Net to bear.

## More traffic, more unpredictable traffic

The world is increasingly dependent on broadband. The use of services where and when users want them, particularly high end video, is driving traffic inexorably upwards. High consumption wireless subscribers will generate 1 GB per day via mobile and Wi-Fi by 2020<sup>1</sup>.

Traffic is also becoming more unpredictable. Demand for services changes with time and location as people move around hour-by-hour, day-by-day, for business and leisure. New devices, services, and applications hit the market constantly and can cause abrupt changes in traffic patterns, giving CSPs no time to prepare. This all makes it increasingly difficult to plan the development and use of network resources.

Meanwhile, the rise of machine-to-machine services is massively increasing the sheer number of connections that networks must manage.

While extra capacity is clearly vital, nobody knows exactly how much, where and when it will be needed. Broadband demand is becoming more fluid.

CSP margins are also being squeezed as the market expands and competition for broadband spending grows. Maintaining profitability depends on improving efficiency and increasing revenues. Higher efficiency will come from better utilization of existing network resources, by moving away from rigid silos of capabilities, by increasing energy efficiency, and by automating common network processes. Extending existing and exploring new revenue streams becomes essential to improve broadband profitability.

Yet traditional telco hardware, while in general very reliable, has been fixed in both location and in its ability to support other uses, with the result that networks are dimensioned to meet peak demand. Like the hardware it runs on, telco software has also been purpose built, tied to both the machine and the functionality it delivers. These software and hardware solutions limit the CSP's ability to combine services in the same way their over-the-top (OTT) competitors have done.

Unless networks gain more flexibility, it is unlikely that a CSP will be able to meet all these challenges.

<sup>1</sup> Nokia Siemens Networks 2011



# Liquid Radio

Redefining base station architecture

Liquid Radio redefines the conventional structure of base stations and repositions their components in new ways to achieve unprecedented scalability.

The concept of a “base station” disappears. Instead the radio can be hidden behind active macro antennas on rooftops or tucked into a small space in any building.

Functionality is determined by software running on versatile, flexible and scalable multi-purpose hardware. The same hardware that supports LTE software can equally well support GSM, HSPA or LTE-Advanced, either separately or concurrently. Furthermore, radio resources such as baseband processing power are shared across a broad area of the network. This allows radio coverage to flow to wherever users need it.

The radio access self-adapts its capacity and coverage to match fluctuating user demand.

This capability is achieved through three key pillars:

## **Baseband pooling frees up unused capacity**

Baseband pooling centralizes the digital signal processing traditionally performed locally at the base station and shares it among several sites. This allows capacity to be used flexibly where it is needed, as not all sites are loaded at all times. Several cells running any technology, from GSM through 3G to LTE and LTE-Advanced, can be connected to one baseband pool.

## **Heterogeneous networks deliver seamless coverage**

Unified heterogeneous networks enable all network layers, based on all frequency bands, all mobile technologies and all cell sizes, to be used as a logically unified network with automated management, seamless interworking and uncompromised quality of experience for the user. The liquid aspect derives from simplifying the management and connectivity of these different network layers with a unified network and experience.

## **Active Antenna System delivers more capacity, precisely**

Replacing passive antennas and radio equipment, for more compact and less complex sites, the active antenna approach supports multiradio and multi-band access for GSM, 3G, LTE and LTE-Advanced, providing up to 65% capacity gain. The technology makes use of several low-power transceivers feeding the passive antenna elements and enabling advanced features such as vertical beamforming which allows capacity to go to different places at different times of the day, to where demand is densest.



# Liquid Core

The foundation of the broadband experience

Today, the core network, typically comprising Circuit-Switched (CS), Packet-Switched (PS) and IP Multimedia Subsystem (IMS) domains, plays a critical role in helping CSPs to take profitable advantage of the exploding popularity of mobile broadband.



Liquid Core smartly tailors and delivers services and content, and dynamically provides the capacity needed to ensure the best customer experience at the lowest cost.

This capability is achieved with two innovative technologies:

## **Core Virtualization uses network resources more flexibly and more efficiently**

Core Virtualization enables any software application to run on COTS ATCA and ultimately on other generic multi-purpose hardware. As well as enabling the re-use of legacy equipment, hardware-independence enables the CSP to take advantage of the latest processor technology developments.

Total Cost of Ownership (TCO) is reduced significantly. When migrating services, for example from CS voice to VoLTE, all MSS hardware can be re-used, cutting new hardware investment by up to 50%. Meanwhile, migrating services from 2G and 3G data to LTE can be achieved while re-using 100% of hardware investments (GGSN/SGSN hardware).

The amount of floor space needed is reduced by up to 80%, and overall power consumption is lower, cutting energy costs by up to 65%, with future evolution improving on even these figures.

Core Virtualization is also a fundamental step towards new business scenarios, such as Private Cloud or Software-as-a-service models.

## **Intelligent Broadband Management automatically delivers the best customer experience**

Through a set of intelligent applications that work seamlessly together, the core network becomes continuously aware of user traffic demands and the network resources that are available to serve those demands. This insight enables the network to manage traffic efficiently by setting end-to-end network resources and by optimizing content and service delivery to achieve the best customer experience.

Although residing in the core, Intelligent Broadband Management ensures that the correct Quality of Service (QoS) is achieved throughout the network. It controls network elements according to self-adapting policy rules and ensures transport and radio network resources are used most efficiently, from the content server right through to the user device.

As well as reducing operational costs, Intelligent Broadband Management helps CSPs to deliver a valuable individual experience to improve customer satisfaction, protect revenue, reduce churn and also open up new revenue opportunities.



# Liquid Transport

Flowing traffic freely across transport network layers

Liquid Transport provides transport services to all possible clients (anything from a base station to an enterprise customer) simply and quickly, while keeping costs as low as possible.

Traffic is channeled along the path of least resistance through the network to get to where it is needed, quickly, efficiently and at the right quality.

This capability is achieved through three key pillars:

**Flexible Optics creates flexibility from rigidity**

Flexible Optics gives optical networks the flexibility to react dynamically to changes in capacity demand. By making the optical transport layer, the lowest layer with the least TCO, more flexible and software-configurable, more traffic can be carried more cheaply than on the IP layer. Many of today's network scalability and cost constraints are removed, supporting rapid service provisioning and low latency: what we call 'zero-constraint networking'.

This approach includes a multi-reach WDM hardware platform and the use of Coherent Transmission technology for faster network speeds without sacrificing reach. Capacity per channel will go from 1G to 100G and beyond, supporting all network scenarios from FTTH to front-haul to long-haul. The interfaces will be software configurable for any bitrate. New optical switches remove any blocking points from the freely flowing traffic while OTN switches ensure highest transmission efficiency.

**Multi-Layer Optimization ensures traffic flows as efficiently as possible**

The Multi-Layer Optimization service optimizes the path of packet connectivity services across all layers, technologies and the topology of a transport network. This multi-layer, multi-technology, multi-vendor

integrated approach achieves maximum scalability and efficiency, as well as lowest TCO (CAPEX savings of 50 to 70% and energy savings of close to 50% are proven).

At the same time, Multi-Layer Optimization improves the user experience by achieving lower network latencies. Furthermore, end-to-end QoS integration ensures that service and user policies are managed consistently throughout the network.

**Intelligent Control provisions services rapidly and automatically**

A multi-layer intelligent control plane is introduced to the network to enable flexible, rapid and easy network operation and service provisioning. The intelligent control plane uses an advanced planning tool, integrates the Operations Support System (OSS) and adds a central path computational element (PCE) to simplify operations and, eventually, to enable automated service switching and in the long term, even network virtualization.

Using the flexibility gained in the optical layer, Intelligent Control enables extremely fast provisioning of services, in other words, 'services in seconds'. This helps a CSP to bring new services to where they are needed very rapidly and with minimum effort, taking care of the quickly shifting traffic demand, while at the same time reducing operational costs by minimizing manual processes.

# Evolutionary, yet transformational

One of the major guiding principles of Liquid Net is that it is non-disruptive. Innovation often comes at a price – the need to replace existing infrastructure with new equipment, wasting previous investments. Instead, Liquid Net takes a fully evolutionary approach that is also transformational.



Liquid Net is more than a vision or a concept. It is a structure for enabling CSPs to meet the demands of today's and tomorrow's communications markets. Importantly, Liquid Net provides the end-to-end network solutions to meet all demands at cost levels that maintain the profitability they need.

**Liquid Net is here today...**

Most of the technologies and components that go together to make up Liquid Net are available today and are already proving their worth in real networks.

This is exemplified by a project for a CSP facing the need to modernize its R99 network, while increasing voice traffic capacity. The Nokia Siemens Networks solution involved swapping out old R99 switches. A single ATCA rack Liquid Core System-based Open MSS replaced two whole floors of R99 switches, giving a much faster deployment compared to legacy technologies and allowing a significant reduction in the CSP's OPEX. Further steps towards full virtualization of the core network have also been undertaken for other CSPs.

**... ready for the future**

Other solutions making up Liquid Net are under development. Furthermore, Liquid Net opens up new possibilities for further innovation to enable CSPs to evolve their networks to cope with developing demands from their customers, no matter what those may be.

With its unlimited potential to meet unpredictable capacity and quality demands, Liquid Net is the industry's most complete approach to managing the ever-changing challenges that CSPs face today and are likely to meet in the future.

## Abbreviations

ATCA	Advanced Telecommunications Computing Architecture	MSC	Mobile Switching Center
CAPEX	Capital Expenditure	MSS	MSC Server
CSP	Communications service provider	OPEX	Operational Expenditure
COTS	Commercial Off-The-Shelf	OSS	Operations Support System
CS	Circuit-Switched	OTN	Optical Transport Network
FTTH	Fiber-to-the-Home	OTT	Over-the-top
GGSN	Gateway GPRS Service Node	PCE	Path Computational Element
GPRS	General Packet Radio Service	PS	Packet-Switched
GSM	Global System for Mobile communications	QoS	Quality of Service
HSPA	High Speed Packet Access	R99	3GPP Release 99
IMS	IP Multimedia Subsystem	SGSN	Serving GPRS Support Node
IP	Internet Protocol	TCO	Total Cost of Ownership
LTE	Long Term Evolution	VoLTE	Voice over LTE
		WDM	Wavelength Division Multiplexing

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