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# **The NGMN Alliance – Operators’ Commitment to deliver a New Mobile Broadband User Experience**

**Dr. Peter Meissner**

**Operating Officer NGMN Ltd.**

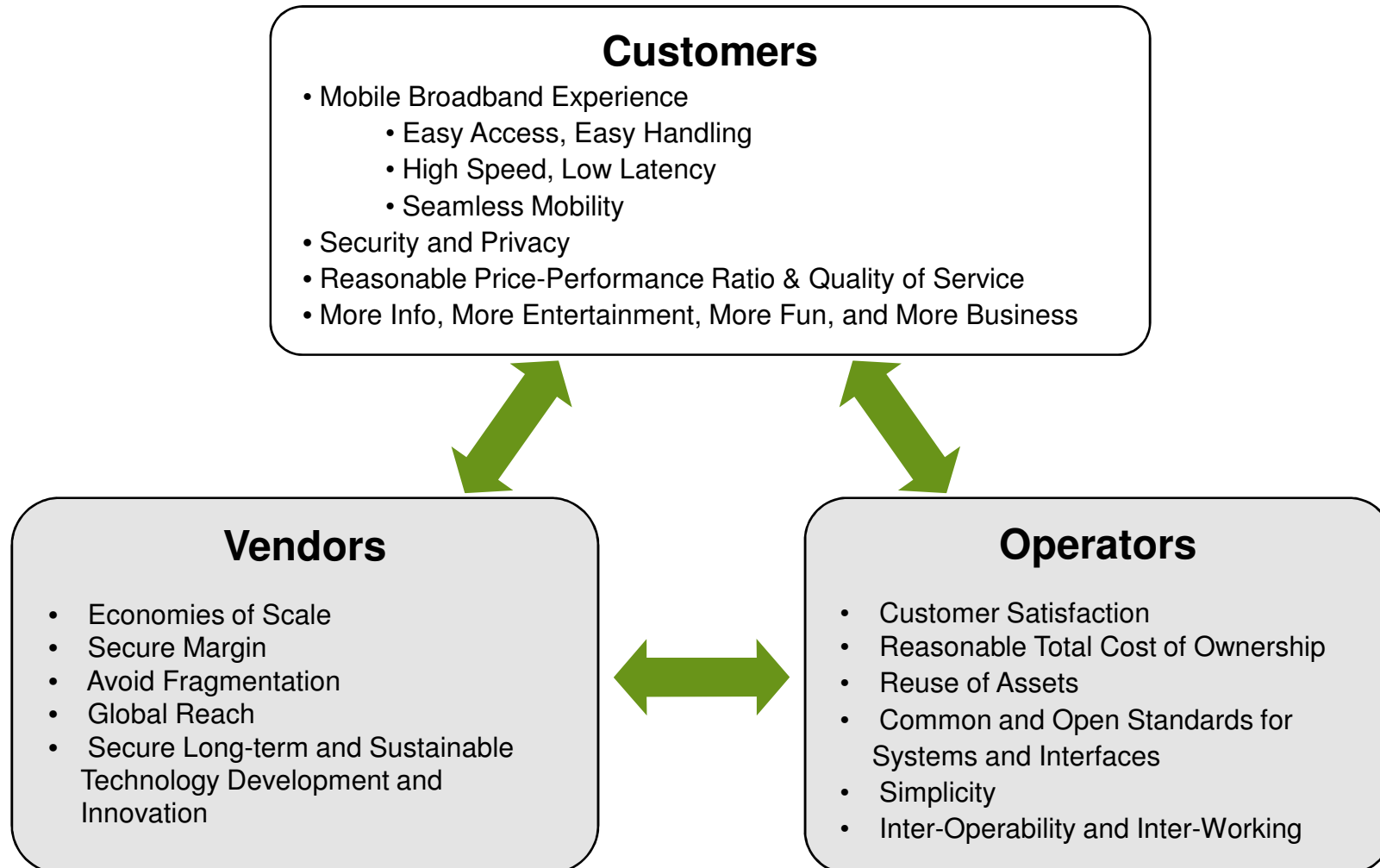
**WWI Innovation Day, Brussels, 13.11. 2007**

# Content

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- Mobile Broadband Ecosystem
- The Alliance
- NGMN White Paper
- Streams of Activities & Status
  - Technical Working Group
  - Spectrum
  - Trials
  - Terminals
  - IPR
- Timeline & Milestones
- Topics for Research, Industry & Standardisation
- Conclusion

# Mobile Broadband Ecosystem (1)



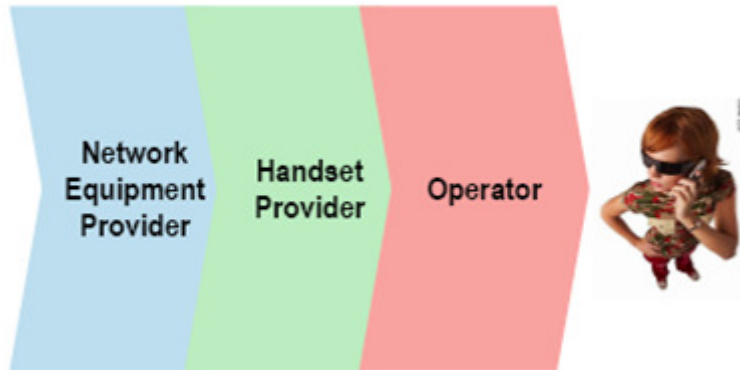
# Mobile Broadband Ecosystem (2)

## Agility & Partnership

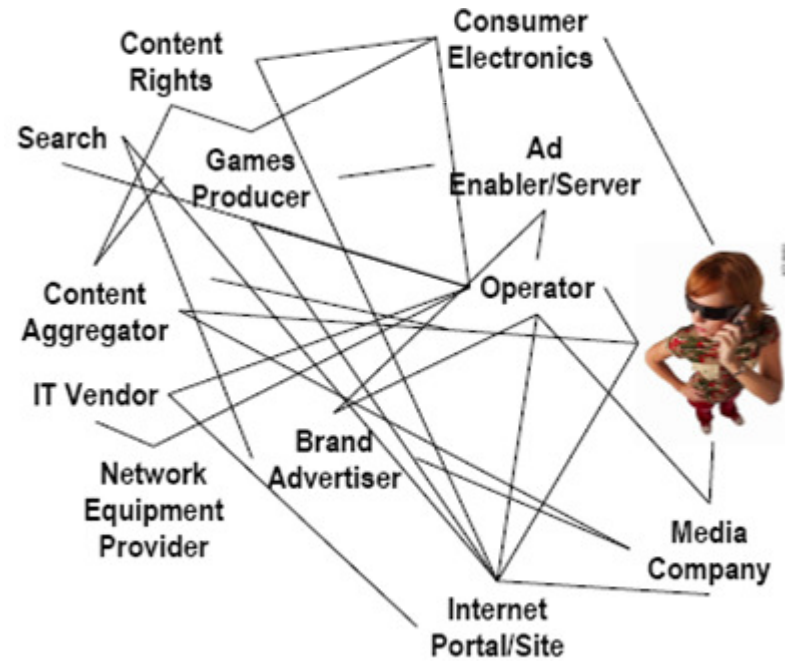


### Experimenting & Partnering in the New World

#### Old Telco 1.0 World



#### New Telco 2.0 World



Source: T-Mobile International

# Mobile Broadband Ecosystem (3)



- In an era of upheavals, wireless service providers/mobile industry
  - Will face many technical and non-technical **challenges**
  - Need to take **collective** as well as individual **actions** to overcome those challenges
  - Need strong and persuasive **collective** (industry-wide) as well as individual **visions**
- **NGMN**, as an agent of change and an ambassador of the end-user, needs to
  - provide the industry with a coherent **collective vision**
  - successfully **synchronise** the ecosystem and create appropriate **platforms** for innovation
  - create a **systematic approach** on what collective actions are required and what is the best approach for implementing them

# Vision and Mission of the NGMN Alliance



“The **vision** of the NGMN Alliance is to provide a **platform for innovation** by moving towards one integrated network for the seamless introduction of **mobile broadband services**.”\*

The **mission** of the NGMN Alliance is “to provide a set of **recommendations** to enhance the ability of mobile operators, who are buyers of infrastructure, in offering cost-effective wireless broadband services for the benefit of their customers.”\*

**Applications win battles, platforms win wars !**

\* White Paper 3.0, NGMN Ltd.

THINK  
BIG



Innovation  
through  
Collaboration

*Next Big Thing*

“Most people’s first experience with Internet will be through a mobile device”

# Role of the NGMN Alliance (1)

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## NGMN ...

- drives **customer-centric** innovation of future mobile broadband
- bundles **operators expertise** to develop a viable ecosystem
- provides **use cases** and incorporates **customer needs**
- is primarily **business driven**
- provides **end-to-end perspective** for future technology needs
- has the objective to **prevent technology fragmentation**

... is **not** another standardisation organisation!

# Role of the NGMN Alliance (2)



**Operators' requirements for the next generation of mobile broadband networks and services.**

**NGMN has key role to deliver operators' requirements to standardisation and verification.**



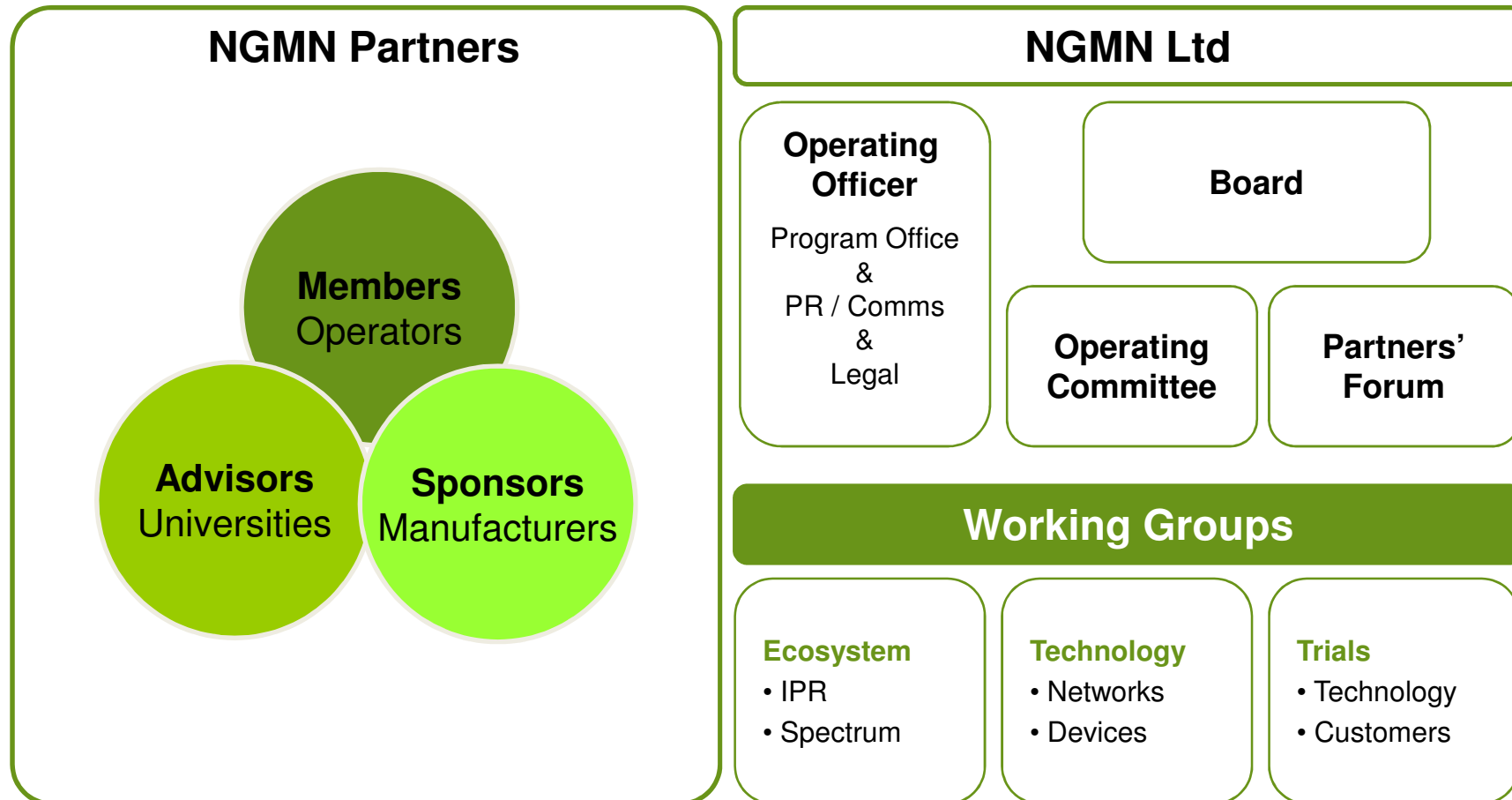
**NGMN could take key role to promote NGMN technologies.**

**Technology neutrality means neutrality on standardisation, verification and promotion.**

**NGMN has key role on harmonisation and globalisation.**



# How NGMN is organised



# Partners of the NGMN Alliance



## Current NGMN Members: 14 worldwide leading mobile operators



## Current NGMN Sponsors: 22 worldwide leading technology vendors



## Current NGMN Advisors: 2 universities / research institutes



Source: NGMN Ltd. Nov. 2007

# NGMN White Paper (1)



**All NGMN partners have agreed on common targets and recommendations in a White Paper ([www.ngmn.org](http://www.ngmn.org))**

- Executive Summary
- Purpose and Scope of Document
- Content of NGMN
- NGMN Overview
- NGMN Recommendations
  - Common Recommendations
  - Radio Access Network Recommendations
  - Core Network Recommendations
  - Terminal Recommendations
  - Service Creation & Delivery in NGMN
- Conclusions
- Annex

# NGMN White Paper (2)



- Executive Summary
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## **Service Continuity**

**Inter-working with Legacy Systems**

**Integration with Heterogeneous Networks**

## **NGMN Migration Path**

**Simplified System and Protocol Structure for Low Latency**

**Transparency of IPR licensing cost**

**Compliance**

**Optimised QoS Architecture**

**Efficient Always-On Support**

**Seamless mobility**

**Network Selection Characteristics**

**Support of broadcast and multicast**

**Open and standardised interfaces**

**Implementation in embedded systems**

**Carrier-grade O&M Systems for Commercial Launch**

**Unified Network Management**

**Self-Organising Networks**

**Security**

**Access Network Security**

**Service Security**

**Mobility Security**

**Charging Security**

**Reliability Support**

**Support for Location Determination**

# NGMN White Paper (3)



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  - **Radio Access Network Recommendations**
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## RADIO ACCESS NETWORK RECOMMENDATIONS

### RAN Applications

#### NGMN Radio

#### Radio Performance

Outperforming spectrum efficiency

Efficient fast state transition times

Efficiency of data multiplexing

Enhanced cell-edge performance

VoIP Capacity

#### Reuse of Resources

Usability of existing sites and antennas

Flexible spectrum usage / efficient usage of scattered spectrum

#### Radio Cost Efficiency

Optimised solution for backhaul transmission

Platform migration

Cost-optimised indoor node design

Reduction of operational costs for network elements

Efficient operation without Soft-Handoff or Macro

Combining

Equipment sharing

# NGMN White Paper (4)



- Executive Summary
- Purpose and Scope of Document
- Content of NGMN
- NGMN Overview
- NGMN Recommendations
  - Common Recommendations
  - Radio Access Network Recommendations
  - **Core Network Recommendations**
  - Terminal Recommendations
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- Annex

## **CORE NETWORK RECOMMENDATIONS**

### **Throughput**

### **Latency**

### **Flexible support for different service classes**

**Support for Real-time & Streaming Services**

**Support for Broadcast and Multicast Services**

### **Roaming and Interconnection Support**

### **Enablers**

**Value Based Charging**

**Single Logical Customer Data Base**

**Packet Inspection for Compliance and Policy Implementation**

**Content Filtering**

**Lawful Interception**

### **Harmonised IP Network Infrastructure**

**Efficient backhaul and core transport cost minimisation**

### **Support for Competitive Cost Structure**

### **Open and Standardised Architecture**

### **Operator Service and Access Management**

**Service Management**

**Access Management**

### **Support for Diverse Bearers**

### **Support for IPv4/IPv6 in an Optimised and Efficient Way**

### **Efficient Routing**

# NGMN White Paper (5)

- Executive Summary
- Purpose and Scope of Document
- Content of NGMN
- NGMN Overview
- NGMN Recommendations
  - Common Recommendations
  - Radio Access Network Recommendations
  - Core Network Recommendations
  - Terminal Recommendations
  - Service Creation & Delivery in NGMN
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## TERMINAL RECOMMENDATIONS

### Early Availability of User Equipment

#### Terminal Certification Regime

### NGMN General Terminal Recommendations

#### Hub Terminals

#### SIM-UE Independence

## SERVICE CREATION & DELIVERY IN NGMN

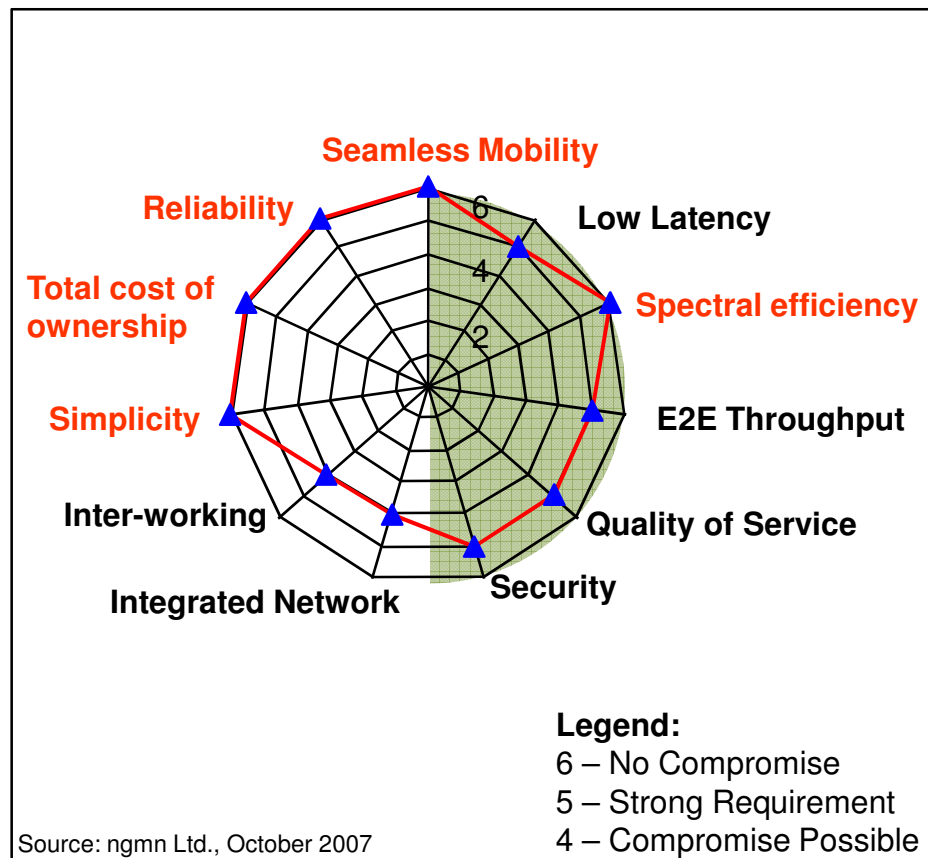
### Service Enablers

### NGMN Interfaces

### NGMN In A Converged Environment

# Key Functional Requirements

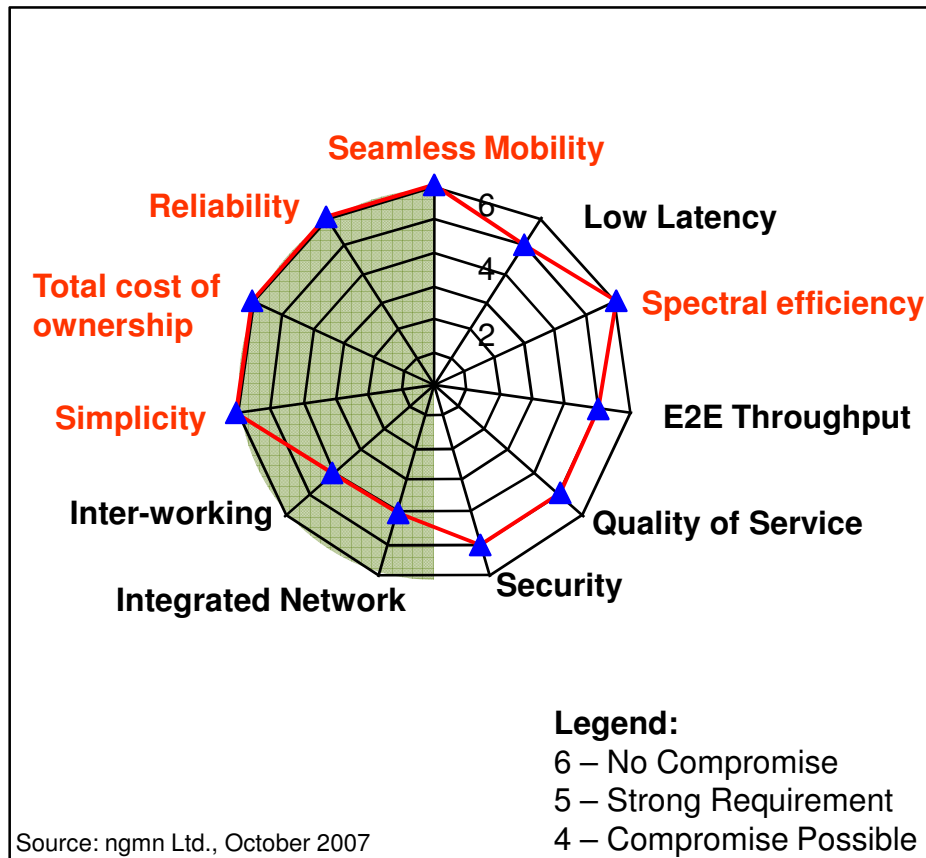
## Drivers for Network Performance



- **Seamless mobility** between adjacent cells with service continuity at a minimum of 120 km/h
- **Low latency** experienced by user (<20-30 ms round-trip time end-to-end)
- **Spectral efficiency** increased by factor 3...5 compared to HSPA & EVDO
- **High end-to-end user throughput**
  - Peak > 100 Mbit/s (@20MHz and two-antenna terminal)
  - Average > 40 Mbit/s (outdoor NLOS environment)
- Predictable **Quality of Service** experienced by user
- **End-to-end Security** spanning from devices to service platforms

# Key Non - Functional Requirements

## Drivers for Network Efficiency



- **Integrated Network**

- Supporting different next-generation access technologies (e.g. LTE, Mobile WiMAX, UMB)

- **Inter-working**

- Level of coexistence with legacy networks (e.g. GSM, UMTS, CDMA-2000, EVDO, WLAN)

- **Simplicity**

- Minimizes complexity of architecture and protocols (e.g. flat architecture)

- **Total Cost of Ownership (TCO)**

- Including cost of migration, reuse of existing assets (e.g. spectrum, sites, antennas), cost of future upgrades, and operational efficiency

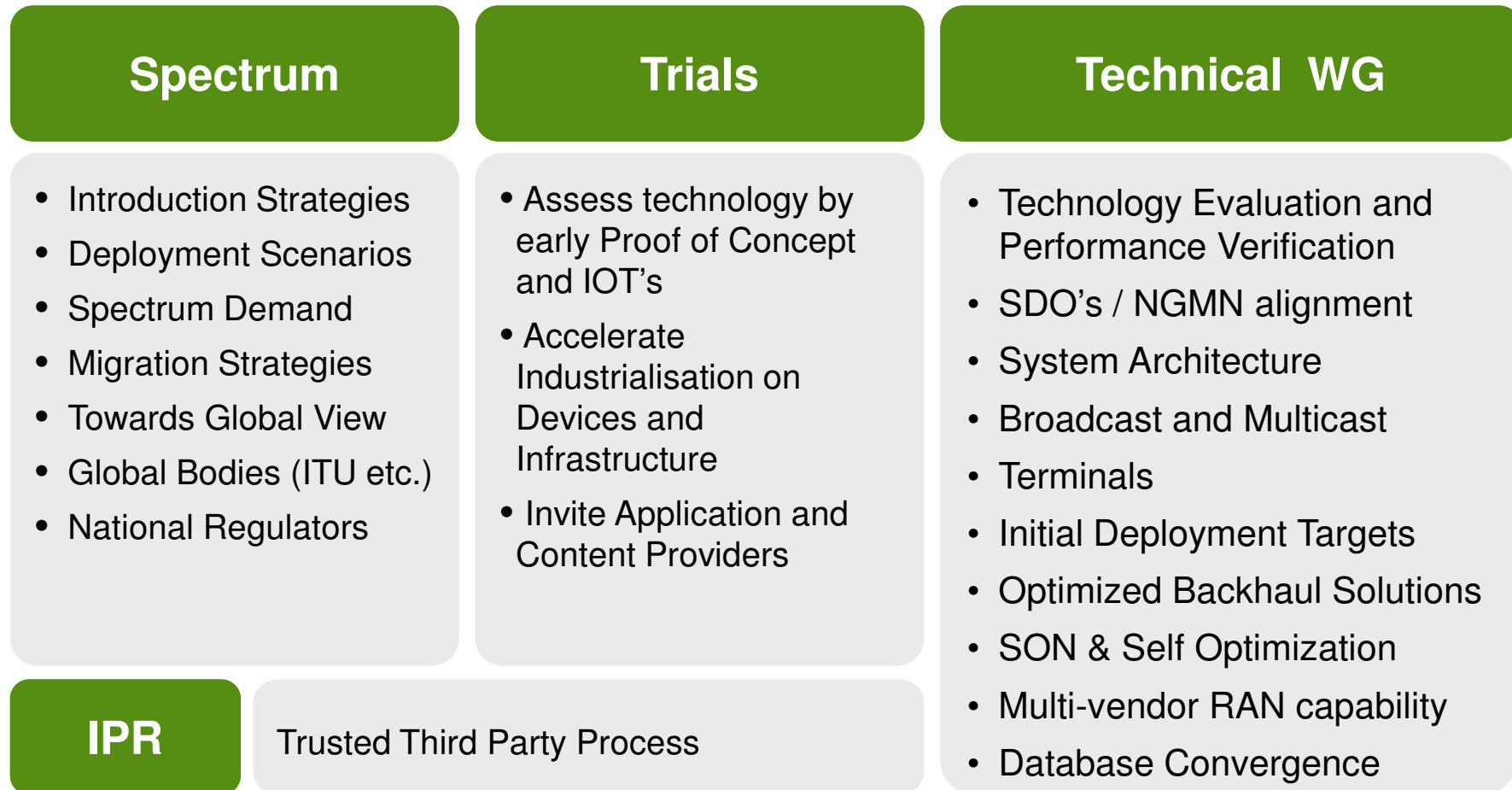
- **Reliability**

- Deliver sustained correct system operation

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# Streams of Activity & Status

# Streams of Activity



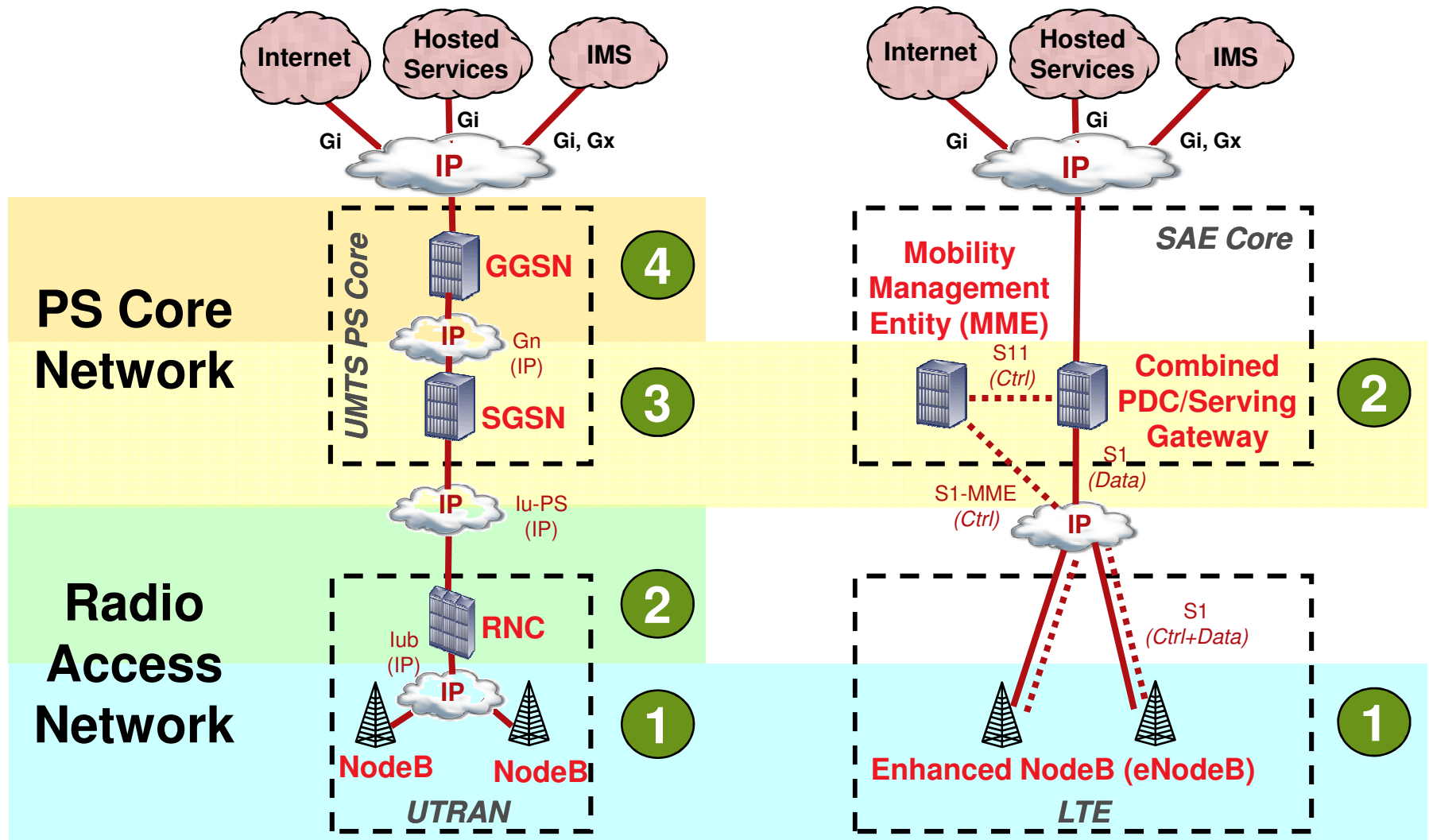
# Where do we stand



- **Flat system architecture** to reduce complexity, costs and latency (common core for different radio access technologies)
- **Performance evaluation methodology** defined & submitted to standards bodies & industry fora
- **Peak throughput** 100 Mb/s DL and 50 Mb/s UL seems to be achievable with all relevant technology candidates in FDD mode (2 x 20 MHz). Not achievable with WiMAX 802.16e TDD mode (1 x 20 MHz)  
**Average cell throughput / spectral efficiency are below target !!!**
- **NGMN spectrum requirements** defined & used for extensive WRC-07 lobbying
- **Demo systems available & trial cooperation** for LTE/SAE and WiMAX initiated
- **Chipset & Terminal** development roadmaps support initial commercial NGMN launches in 2010
- **Certification** initiative launched
- **IPR TTP** Process launched

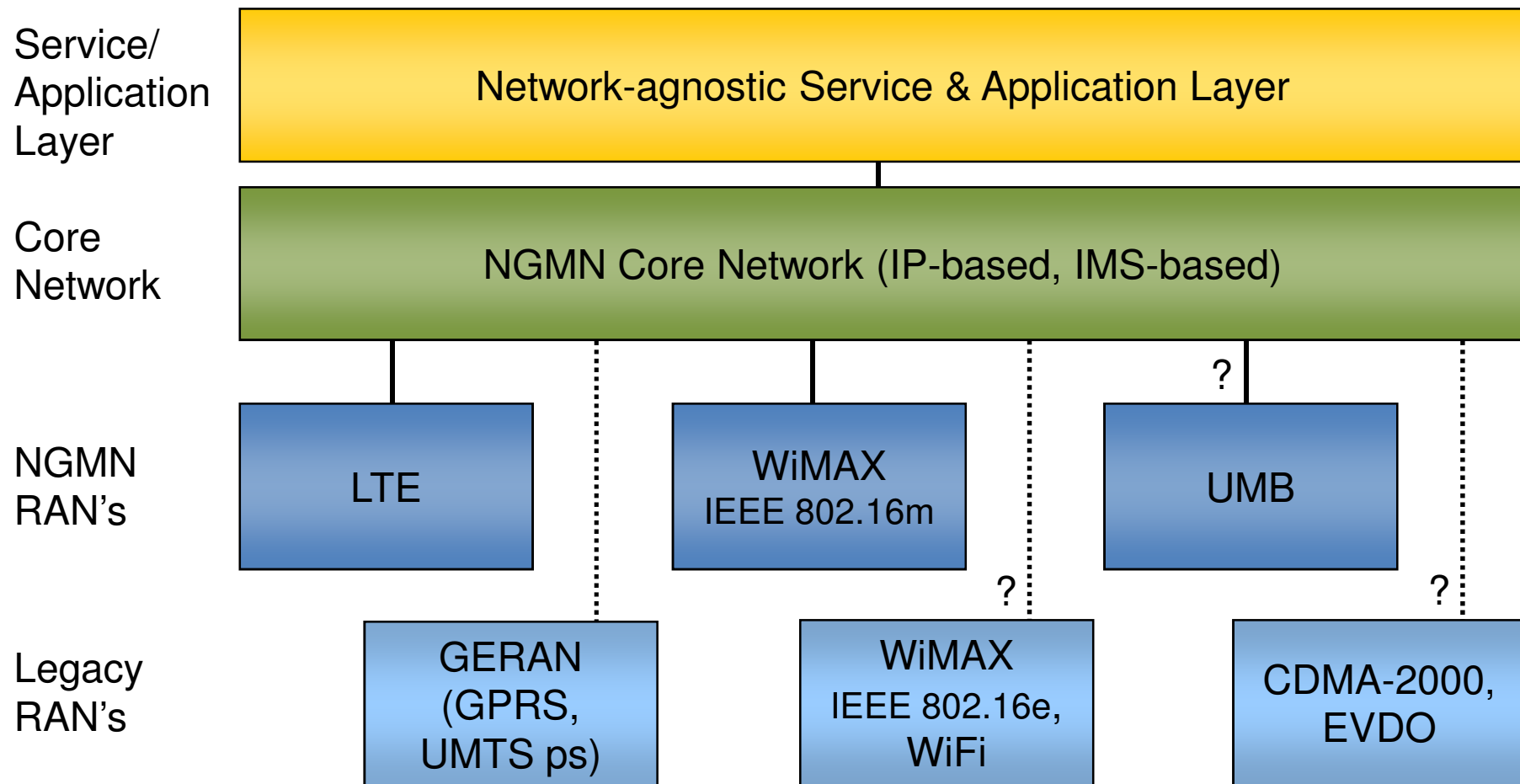
# Flat NGMN System Architecture

4 Hierarchical Node Layers Reduced to 2 Node Layers



# NGMN Vision of One Common Core Network

Adopted and Being Specified by 3GPP for LTE and WiMAX



# Performance Evaluation Methodology



## EVALUATION METRICS

### Fairness

Criteria: normalised throughput bound

### Data Rates and Spectral Efficiency

Peak User Data Rate

Throughput

Spectral Efficiency

VoIP capacity

Broadcast and Multicast Service Evaluation

Latency

Connection Setup Latency

Radio access transmission latency

The end-to-end packet call latency

Handover interruption time

### Other Metrics

Contour Plot of Minimum Service Level

User geometries and interference statistics

Control channel and pilot overhead

Link: <http://www.ngmn.org/index.php?id=7>

Table 4 User Traffic Mix

Application	Traffic Category	Percentage of Users
FTP	Best effort	10 %
Web Browsing / HTTP	Interactive	20 %
Video Streaming	Streaming	20 %
VoIP	Real-time	30 %
Gaming	Interactive real-time	20 %

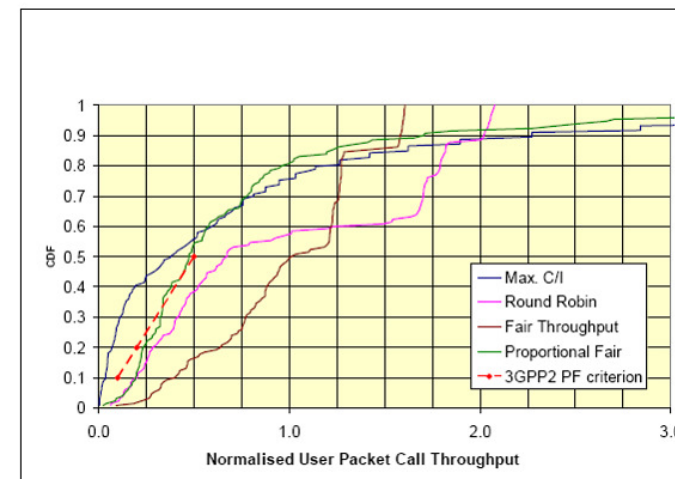


Figure 1 Cumulative Distribution Function (CDF) of Normalized User packet Call Throughput: Example 24

# NGMN Candidate Technologies & Evaluation Criteria (Strawman)



	NGMN Requ.mt.	LTE FDD	LTE TDD	WiMAX 16e TDD	WiMAX 16e FDD	WiMAX 16m	UMB
<b>Performance</b> - Peak Data Rates - Average Throughput - Spectral Efficiency - VoIP Capacity - Latency/RTT							
<b>Functionality</b> - Mobility, HO, Roaming - QoS, Always-on - IP architecture - MBMS - Multi-RAN - Security, etc.							
<b>Interworking</b> - Backward Compatibility - I/w with legacy systems							
<b>Time-to-Market</b> - Availability & development milestones for - Standards - Spectrum - Terminals - Infrastructure - Migration paths							
- Eco-system, Cost issues - Aggregated IPR Terms							

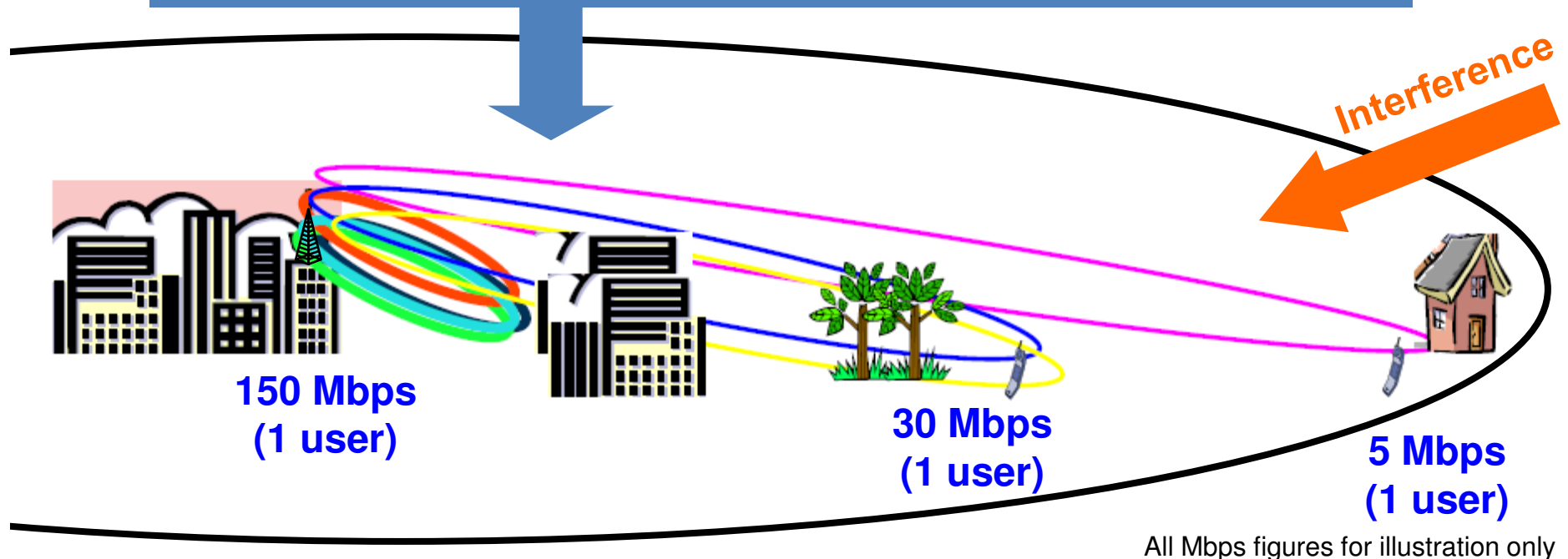
To be completed ...

# Average Throughput & Spectral Efficiency **ngmn**

the engine of broadband wireless innovation

Average Cell Throughput is crucial for Wide-area Mobile Deployment

Assuming a homogeneous spatial distribution of users, this radio cell can in average deliver an aggregated data throughput of ~ 30 - 40 Mbps (for 1 user or shared between several users)

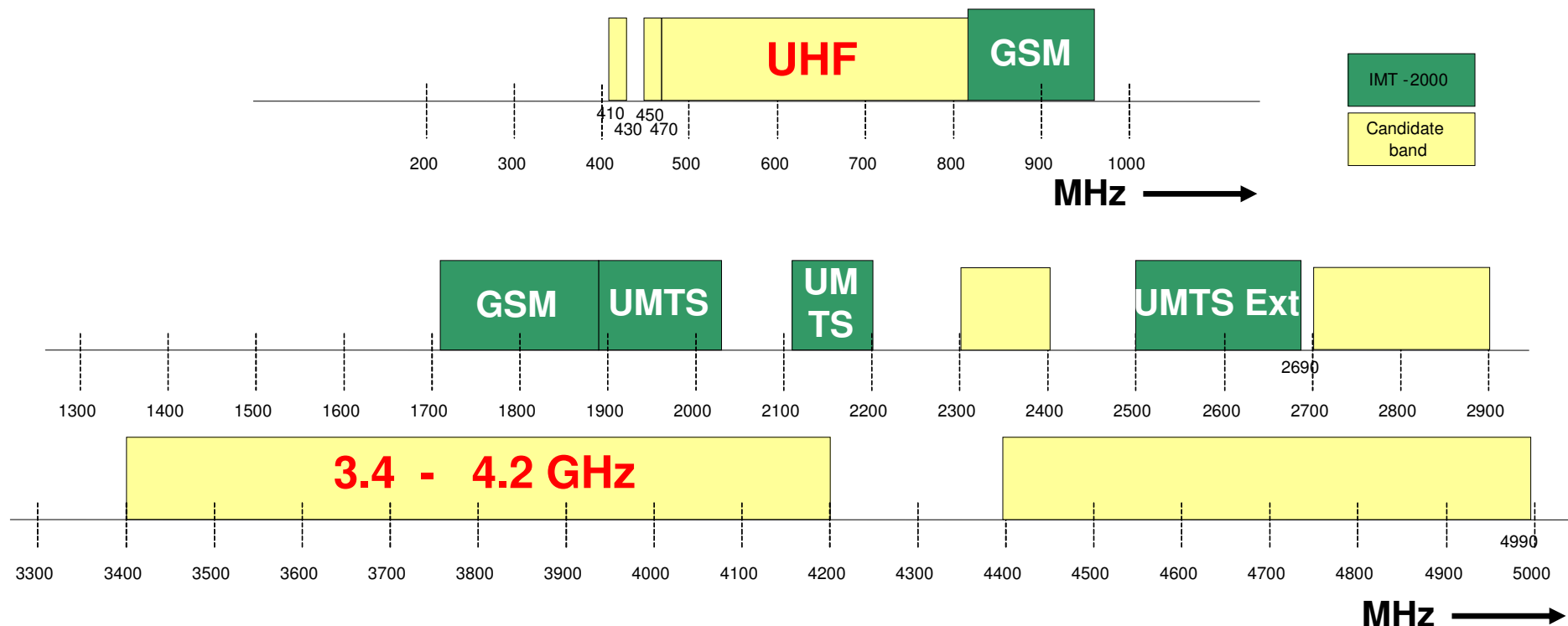


- Average aggregated cell throughput divided by the used bandwidth (e.g. 20 MHz) defines the Spectral Efficiency (bps/Hz/cell)

# Spectrum Bands relevant for NGMN

## IMT-2000 Bands and Candidate Bands for IMT-Advanced

- NGMN can be deployed in all IMT-2000 and IMT-Advanced frequency bands
- UHF and 3.4 – 4.2 GHz are the main candidates for additional spectrum allocations at WRC-07

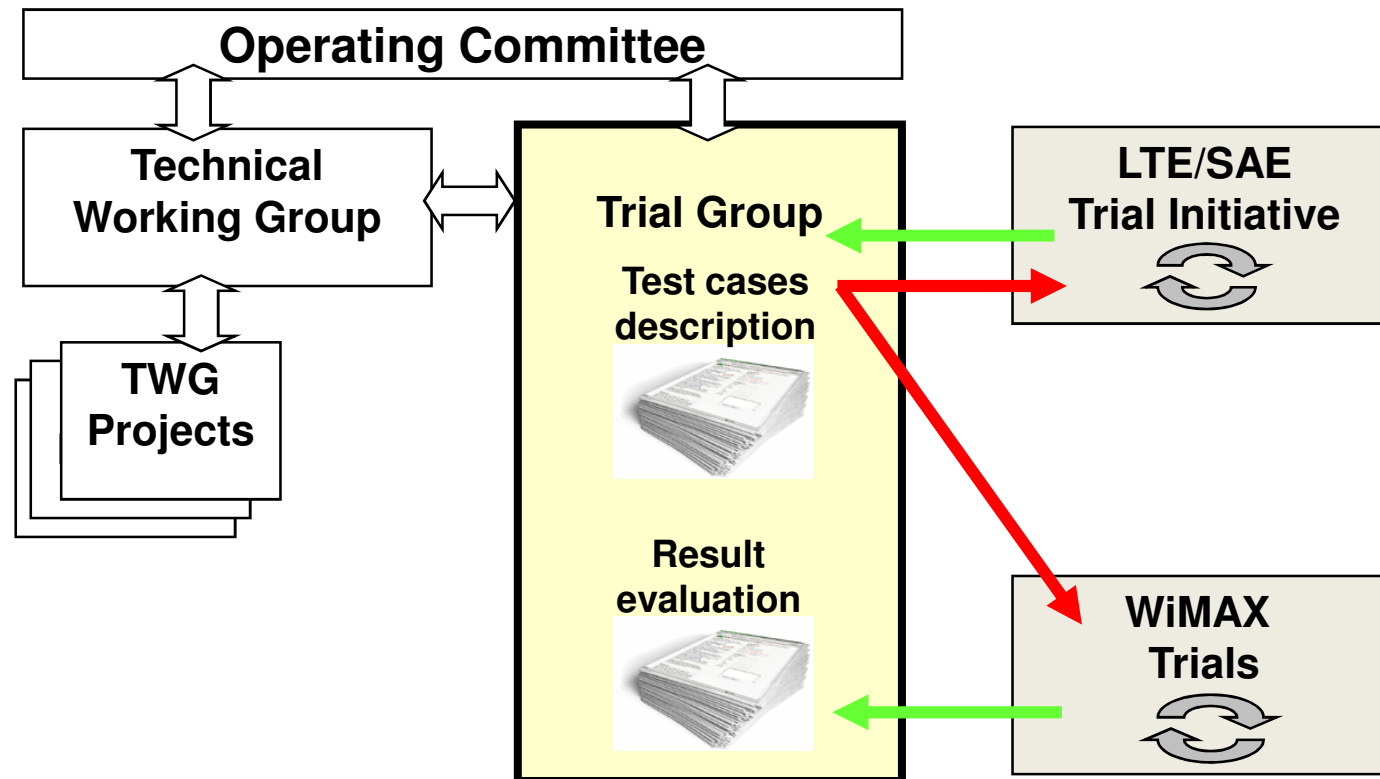


Source: MIB

# Trial Group

To validate Technology Capabilities and Standards ...

- Trial requirements and test cases under development
- Collaboration with LTE/SAE Trial Initiative (LSTI) set up
- Sprint is leading phased WiMAX trials with key WiMAX vendors



# Terminal Certification (1)

## Overview

### Scope

Give recommendations on:

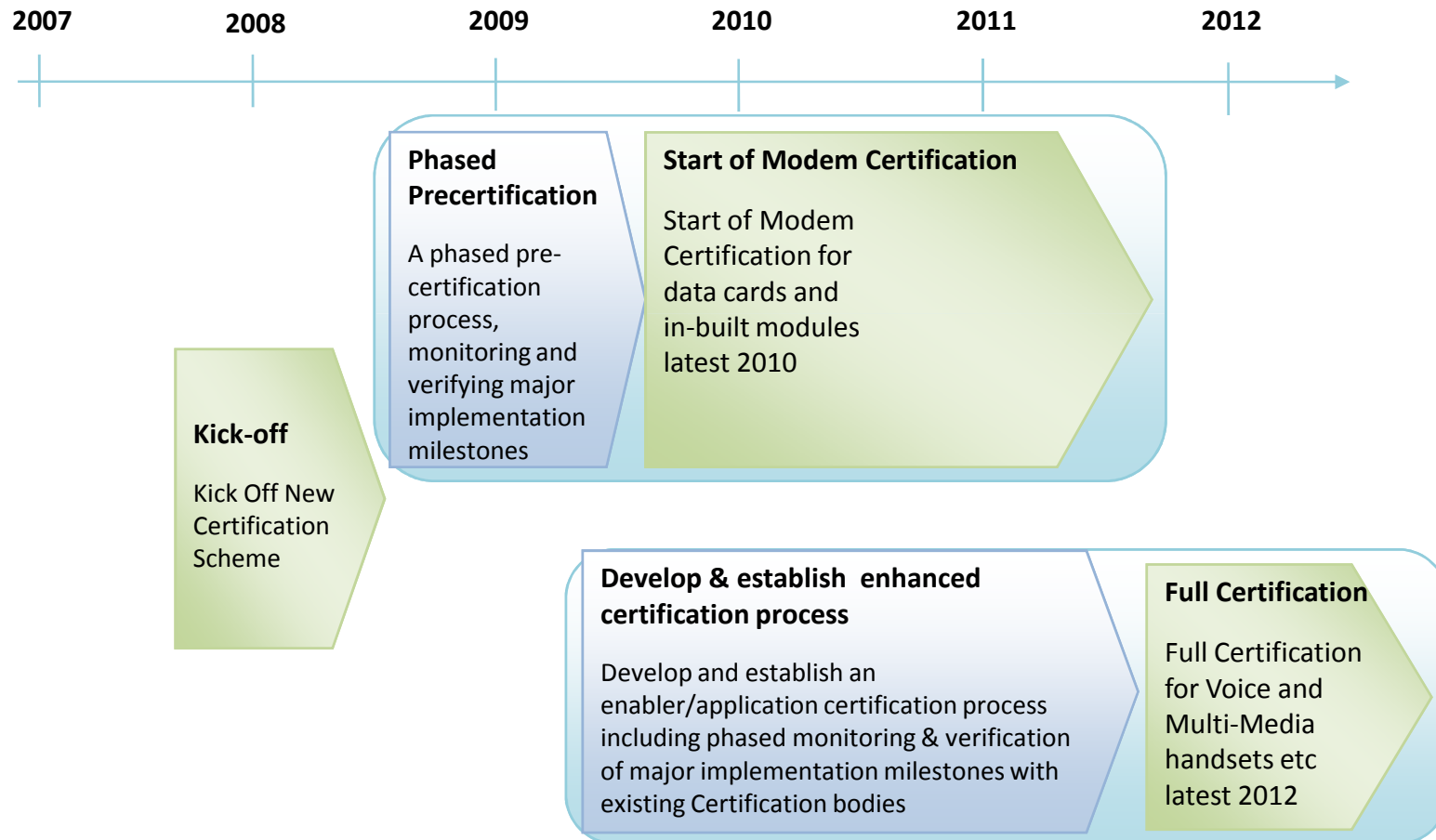
- Necessary changes in the current certification regime (GCF, PTCRB)
- Clarify the needs from an operator perspective what are the prioritised feature sets
- Timing needs in relation to feature sets
- Optimize the certification process

### Objectives

- Shorten the lead-time from available standard to certified terminal (compare UMTS: this process took 4 years!)
- Enhance quality for first products
- Enhance terminal certification by stronger use of real network infrastructure
- Reduce testing & certification costs for all partners

# Terminal Certification (2)

## Timeline



# IPR / Trusted Third Party

## Major Achievements and Planning 2008

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### **IPR Principles:**

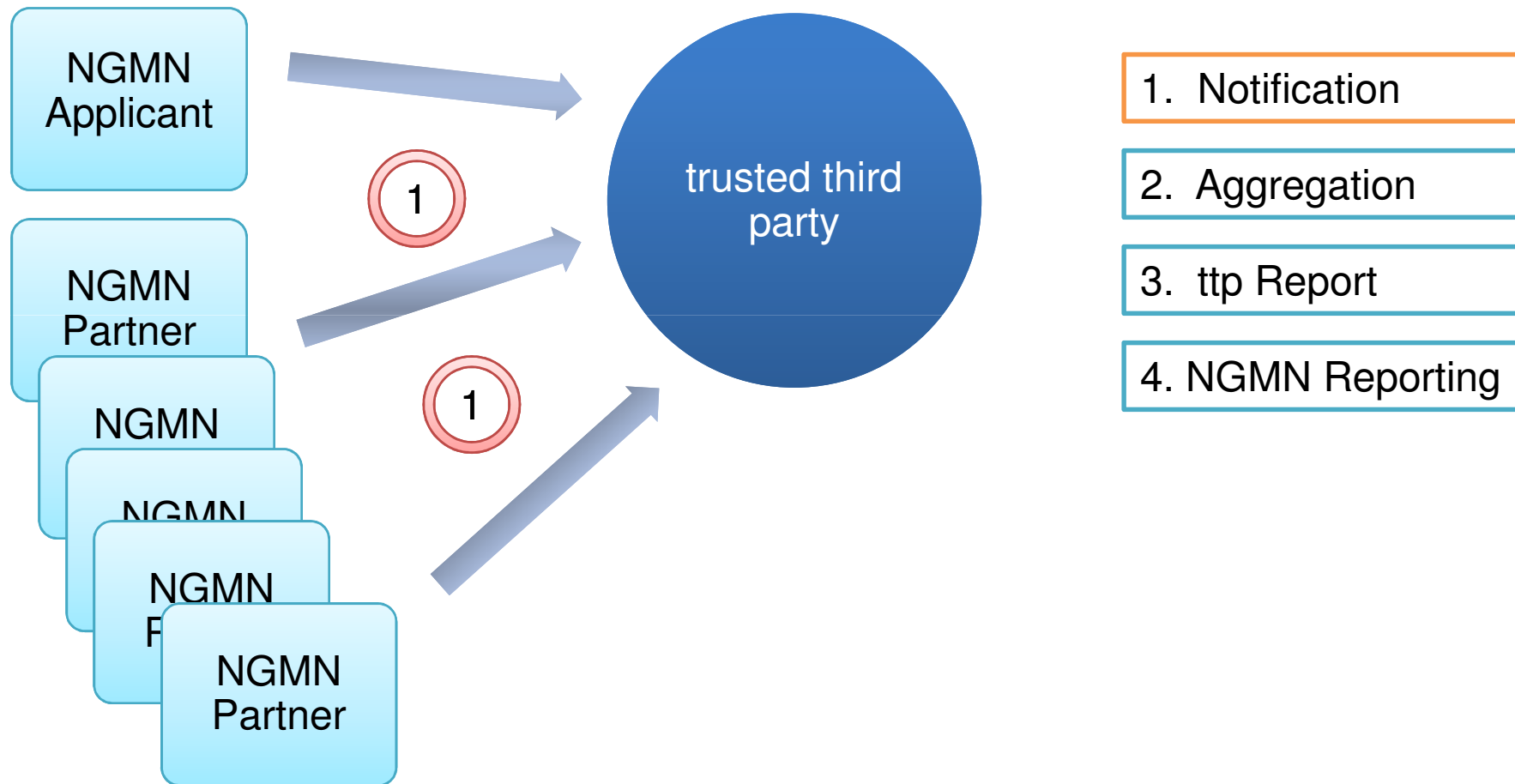
- FRAND
- Mandatory Ex-Ante
- Aggregated Terms

### **TTP Process:**

- Process has been agreed with all partners
- Secure processes implemented with Trusted Third Party
- 1<sup>st</sup> official run with all partners in Sept./Oct. 2007
- 1<sup>st</sup> official TTP report to NGMN Office Nov. 2007
- Next TTP run planned Q1 2008

# IPR / Trusted Third Party

## Overview ttp Process



# IPR / Trusted Third Party

## Overview ttp Process



1. Notification

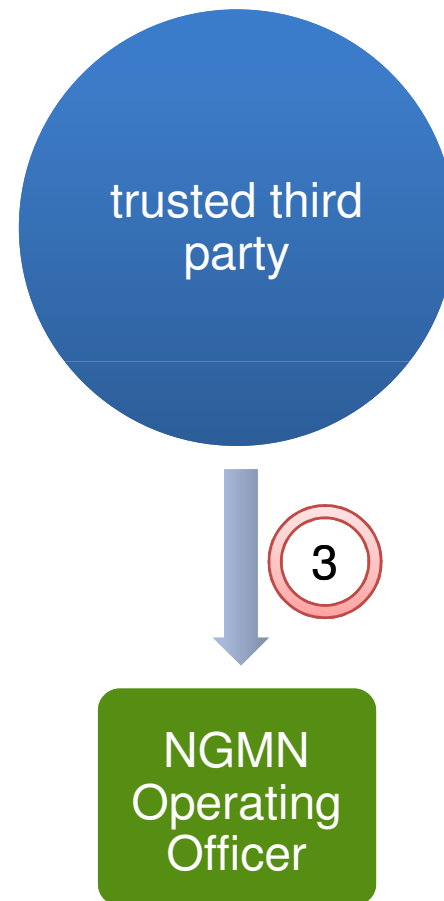
2. Aggregation

3. ttp Report

4. NGMN Reporting

# IPR / Trusted Third Party

## Overview ttp Process



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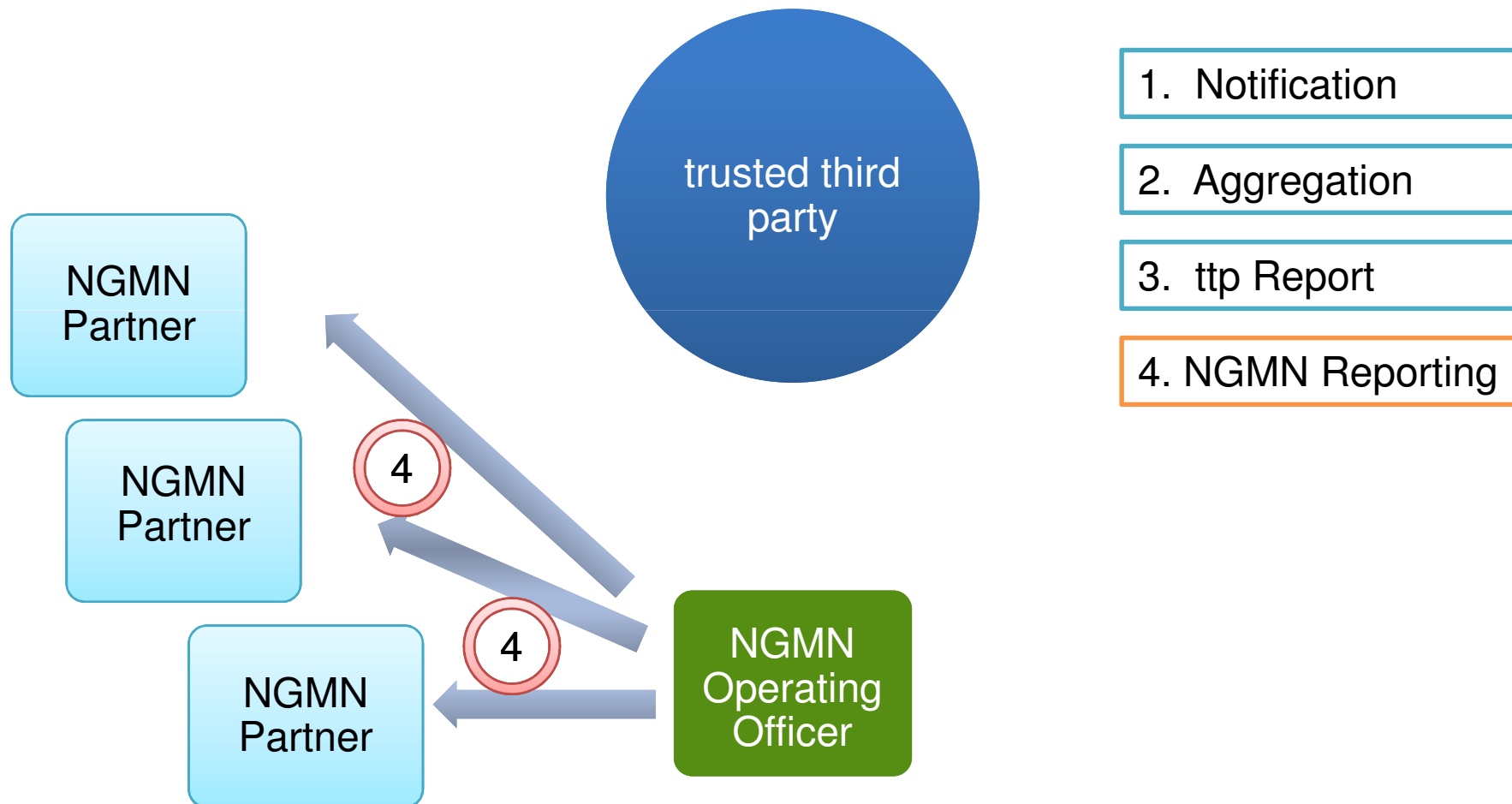
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# IPR / Trusted Third Party

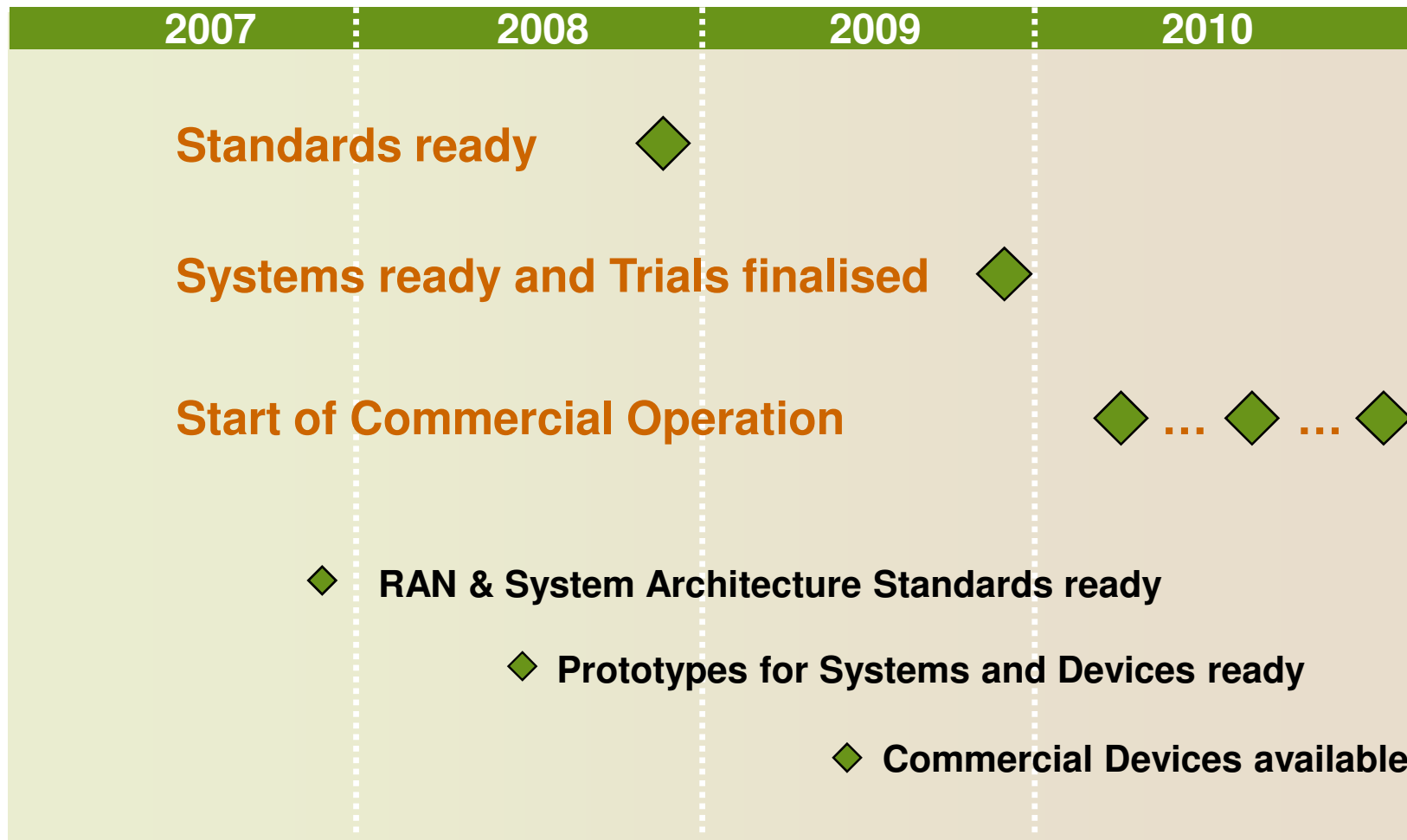
## Overview ttp Process



# Timeline & Major Milestones

# Milestones

Drive Recommendations into Standards

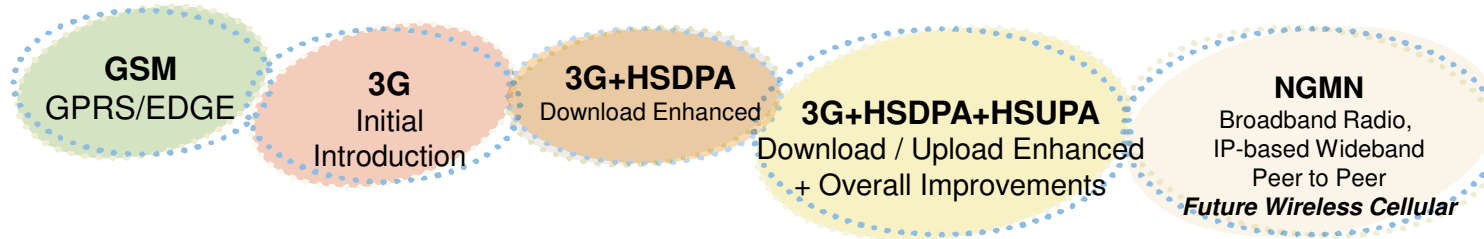


# Roadmap



Year				
2002 - 3	2003 - 4	2005 - 6	2007 - 9	Next Decade
64 -144 kbps	64 - 384 kbps	0.384 - 4 Mbps	0.384 - 7 Mbps	40+ to > 100 Mbps

DL Throughput

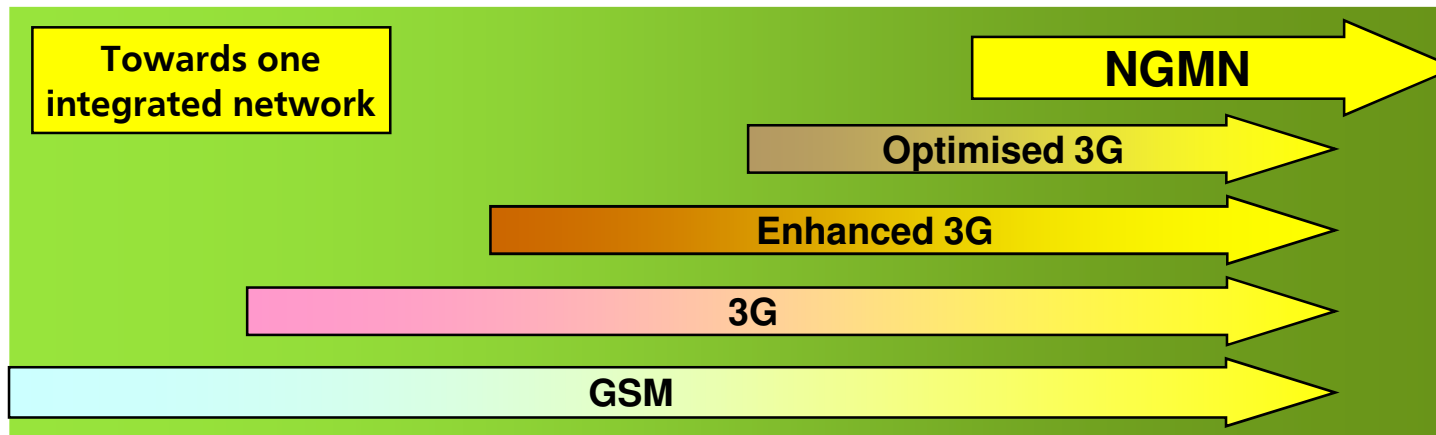


Enhanced  
Broadband Mobile  
Mobile Services

Multimedia  
Cellular

Enhanced  
Multimedia Mobil

Optimised  
Multimedia Mobile Communication



## Topics for

- **Research**
- **Industry & Standardisation**

# Topics for Research



- **Cell edge** problem: Average throughput versus maximum throughput hype  
How to improve average throughput & spectral efficiency ?  
→ **More research required to meet NGMN performance requirements !**
- How to further enhance **Voice capacity** (VoIP)
- **MIMO** 2x2 versus 4x4
- Beyond state-of-the-art **speech & channel coding**
- Improved **routing efficiency**
- Efficient **backhauling** technologies
- Efficient **Always-On** implementation (terminals / packet nodes)
- **Multi-vendor** RAN / O&M
- **SON** – self-organising, self-optimising networks
- **Femto cells** / self-deployment
- Rigorous design for **low cost**

# Topics for Industry & Standardisation

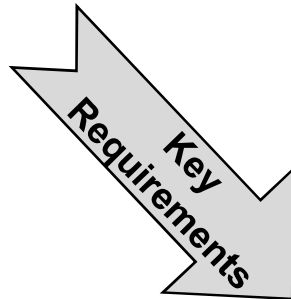


- **One common core** for different access technologies
- **One global standard** for next-generation mobile networks
- Main **use cases**
- **Initial deployment** scenarios (in-house access points / femto cells vs. wide-area outdoor, which spectrum, feature priorities, etc.)
- **Long-term** network **migration & substitution** (“beyond 2020”)
- How long will **legacy networks** survive / how much legacy interworking do we need ?
- Role of **fixed mobile convergence**
- End-to-end and cross-network **security** and authentication aspects
- Others ?

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# Conclusion

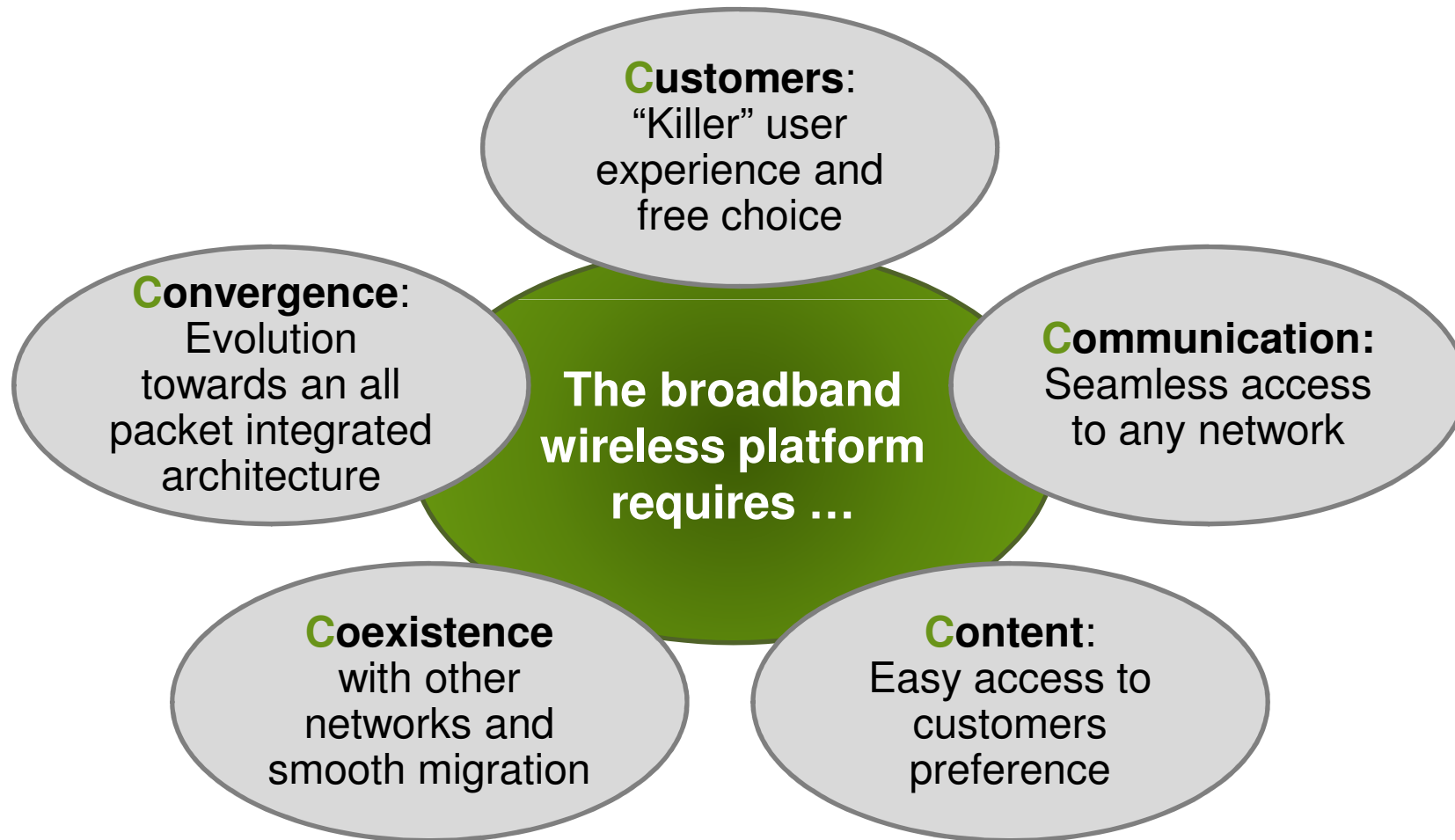
# End-to-End Requirements



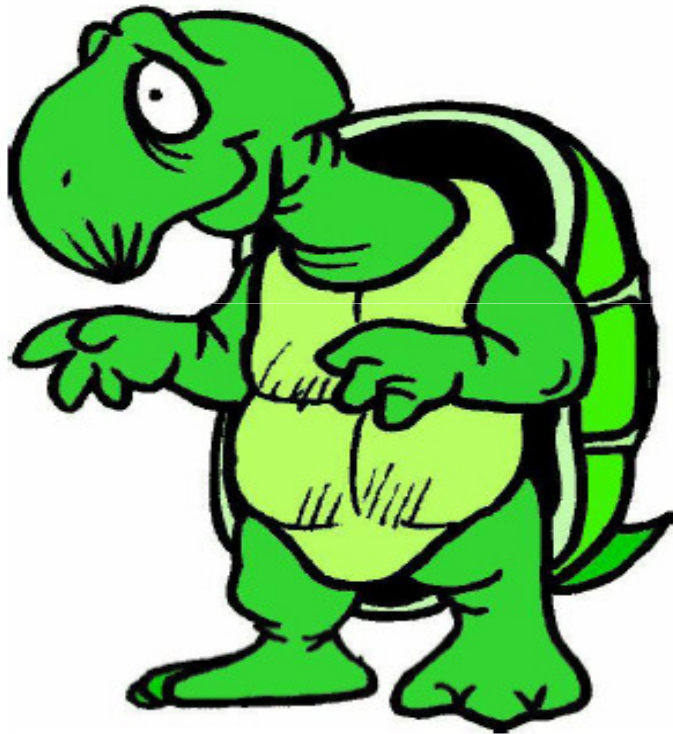
	ACCESS	CORE	ENABLING PLATFORMS	DEVICES
<b>Interactive sessions &amp; virtual games</b>	Low latency	Low latency	Open interfaces	User friendly & adaptable
<b>Broadcast / Multicast</b>	High throughput	Effective control	Open interfaces & cost effective	High resolution & adaptable size of screens
<b>E-mail &amp; web-browsing</b>	High throughput	QoS	Seamless interworking & common interfaces	Multifunctional interfaces
<b>Multimedia conferences</b>	High throughput	QoS	Security & reliability	High functionality & intuitive user functions

**Don't forget voice (over IP) and video telephony !**

# Key Success Factors for the Ecosystem



# General Challenge for the Industry



“Most people’s first experience with Internet will be through a mobile device”

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A large version of the ngmn logo, centered on the page. It consists of the letters 'ngmn' in a bold, green, sans-serif font, with the tagline 'the engine of broadband wireless innovation' in a smaller, black, sans-serif font below it. The text is surrounded by a large, intricate pattern of overlapping, light gray, wavy lines that create a sense of motion and connectivity.

**ngmn**

the engine of broadband  
wireless innovation

**Thank you**