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# Infrastructure Sharing and Access

Globally, sharing of infrastructure has become an increasingly important tool for mobile and fixed operators and regulators to achieve business, development, and policy objectives in recent years.

#### 2000s 1990s 2010s · Discouragement or outright Increasing tolerance of passive · Increasing adoption of active sharing by prohibition of infrastructure sharing infrastructure sharing by Regulators network operators, particular in urban areas and · Mandated and voluntary national roaming in-building networks in order to facilitate infrastructurebased competition Geographic-split sharing in rural areas regimes · Widespread duplication of • Emergence of shareable active network Infrastructure-sharing extended to backhaul, technologies backbone and even core networks infrastructure Emergence of MVNOs • Emergence of Tower Companies Regulatory focus on service-based competition · Interconnection and Access facilitated · Unbundling of value chain into NETCO and Incumbents and PTTs subject to Dominance Designationthrough RIO/RAO regulation OPCO entities to reduce duplication of related regulation · Mandated colocation infrastructure • CPS/CCS Regimes Duct-sharing requirements Emergence of shareable in-building network Local Loop Unbundling solutions Wholesale Access Wavelength-based unbundled GPON Interconnection frameworks Public funding/subsidisation of infrastructure

 Infrastructure sharing is now widely-accepted by both operators and regulators as critical to their shared mission of expanding access and increasing affordability, whilst minimising environmental impacts.  Successful realisation of the significant economic, social, and environmental benefits of sharing requires a robust, well-structured, wellmanaged, and stable regulatory framework.



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# Mobile infrastructure sharing – regulatory implications

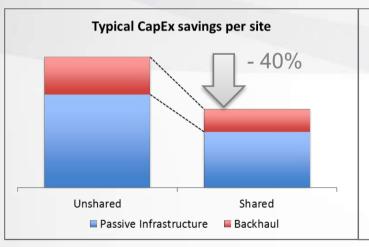
Infrastructure sharing is recognised as a potential source of significant OpEx savings by operators. Operators in the roll-out phase also benefit from substantial CapEx savings.

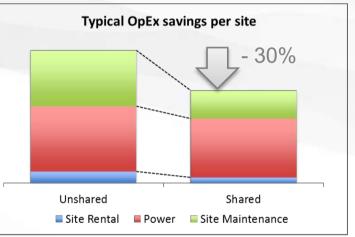
Types of sharing		Strategic drivers	Regulatory implications
Sharing passive infrastructure	Site (co- location)	<ul> <li>Reduced site acquisition times for new entrants</li> <li>Access to strategic locations, e.g. where space is limited</li> <li>Increased likelihood of obtaining planning permission for new sites</li> <li>Reduced OpEx (site lease)</li> <li>Expansion to previously unprofitable areas by reducing CapEx/OpEx</li> <li>Environmental and alleged health concerns</li> <li>Shared power solutions &amp; backup, generators/batteries/solar etc.</li> </ul>	Limited regulatory issues; regulators generally permit and often actively support passive infrastructure sharing
	Mast (tower)	<ul> <li>Reduced site acquisition and build completion times</li> <li>Reduced CapEx (site build)</li> <li>Reduced environmental and visual impact</li> </ul>	
Sharing active network components	RAN	<ul> <li>Reduced number of sites and masts for the same coverage</li> <li>Expansion to previously unprofitable areas by reducing CapEx/OpEx</li> <li>Reduced CapEx and OpEx (shared physical backhaul)</li> </ul>	May be subject to licence conditions
	Trans- mission	<ul> <li>CapEx and OpEx saving through more efficient use of bandwidth</li> <li>Reduced maintenance and operational costs</li> </ul>	Need for compatible spectrum licence
Sharing by network interconnect	MVNO / Roaming	Access to geographical areas not covered by own licences	Often subject to regulations



# Typical financial benefits of mobile N/W sharing

Passive infrastructure sharing may produce per site savings of typically 40% on CapEx and 30% on OpEx. Additional substantial savings can be obtained through sharing of transmission. Total savings will depend actual synergies realised between the operations.





- Key assumptions:
- 40% CapEx savings for each operator (as there are additional costs for more robust tower installations and backup power, separate shelters, etc.)
- 50% OpEx savings for each operator on site rental and site maintenance
- 10% OpEx savings for each operator on power

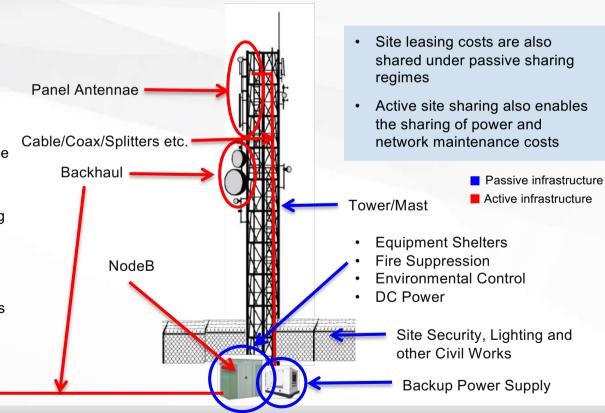
- For each site shared, typical CapEx savings of 40% and OpEx savings of 30% can be achieved
- Total savings will depend on synergies that can be realised between existing an planned infrastructures of the involved operators
- Quantifying more precisely the potential savings that can be achieved through infrastructure sharing will require analysis of specific potential synergies



### Shared Active and Passive Infrastructure

Sharing of active infrastructure is technically and legally more complex than passive sharing, but yields significant additional CapEx and OpEx savings.

- Sharing of passive infrastructure has enabled operators to half common CapEx investments (such as towers and site civil works), as well as site OpEx (such as site leasing expenses)
- Under active sharing arrangements, operators deploy network infrastructure engineered to support two or more operators requirements. Further OpEx savings are realised by sharing network maintenance costs.
- Realising savings from sharing under both types of regimes requires an initial increase in CapEx, arising from the need to reconfigure existing sites: passive sharing sometimes requires existing towers to be upgraded or replaced. Active sharing is typically done under a "geographical split' arrangement, requiring wholesale reconfiguration of both operators existing network sites.
- As data volumes have grown, sharing of backhaul costs has become an increasingly significant contributor to total OpEx savings.



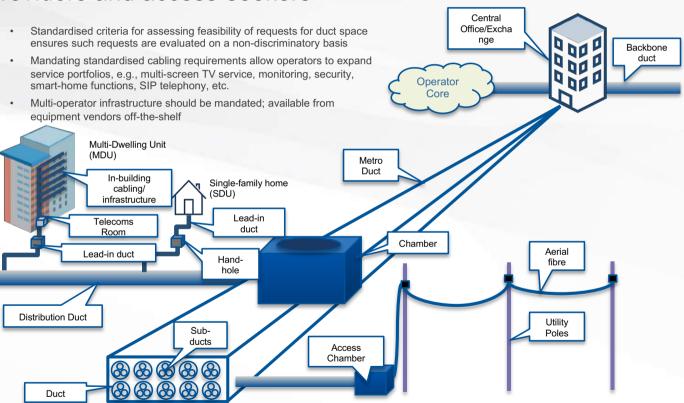


# **Outside Plant Sharing and Access**

Design, topology and regulatory frameworks governing fibre networks have competitive implications for both access providers and access-seekers

### Outside Plant - Key Issues

- · Ducts are bottleneck facility; not easily replicable
- Civil works typically 70 80% of cost of FTTx network rollout: sharing of duct reduces cost and speeds roll-out
- Incentive to invest in duct infrastructure must be preserved
- Design specifications must support multi-operator model
- Design criteria that accommodate needs of both road authorities/municipalities constructing the ducts and network operators that use them
- Minimise cost and accelerate implementation by standardising design and streamlining approval process
- Access and usage pricing that fairly compensates infrastructure provider without imposing excessive costs on operators
- In-building infrastructure codes support multioperator model through design and standardisation
- End-user utility enhanced by mandating installation of standardised cabling throughout dwelling

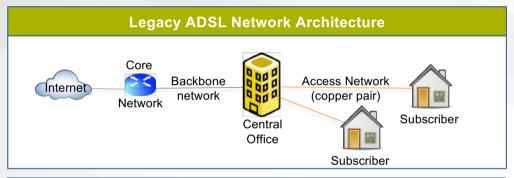


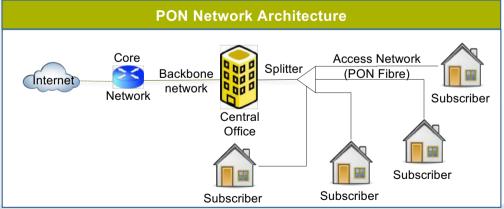
\*Corning



# Technical Challenges to Fibre Sharing

Sharing of fibre infrastructure presents unique challenges to the regulator, due to technical issues that preclude the use of solutions (such as LLU) that were employed by regulators to mandate sharing of ADSL networks.





- With ADSL technology, regulators typically mandated unbundled access to copper local loops by requiring incumbents to provide collocation in central offices to new entrants; subscribers could switch service providers simply by reconnecting a dedicated copper pair from the incumbent's MDF to the the competitor's.
- PON has emerged as the dominant network architecture for FTTx (primarily driven by lower CapEx requirements than alternatives (e.g., P2P fibre); such networks employ one or more levels of fibre splitting, with the final splitter typically located near the end user, making unbundling at a central location impossible.
- Both types of networks can be (and have been) unbundled through wholesale bitstream service.
- New technologies employing wavelength unbundling over PON networks are expected to be commercially available in the near future, are expected to provide another mechanism for sharing of fibre infrastructure amongst multiple operators.

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# Sharing of Fibre Infrastructure

Whilst sharing models vary across markets, the consensus view amongst regulators is that the optimal market structure imposes tight regulation on the infrastructure market whilst facilitating unconstrained competition on the service layer.

Layers 4-7 (applications)

Layer 3 (network/IP)

Layer 2 (transmission)

Layer 1 (physical)

Layer 0 (duct)

Intesity of Regulatory Oversight

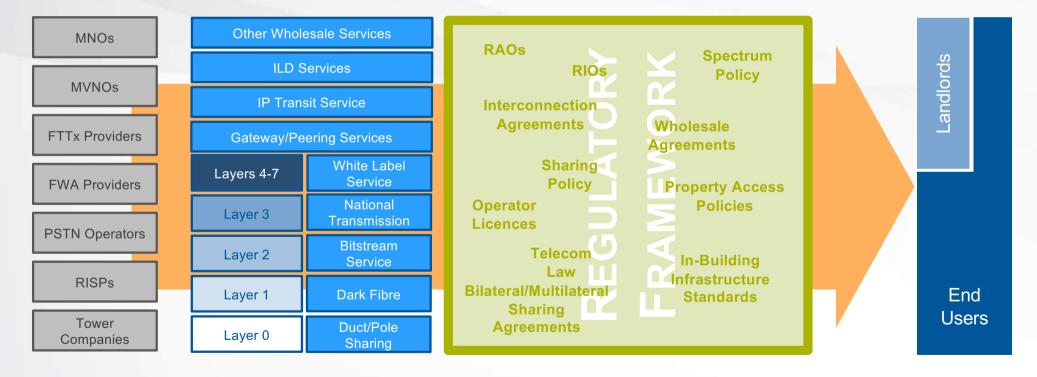
- The optimal mechanisms for achieving this result varies from market to market, depending on numerous factors including market market maturity, market concentration, existence and nature of legacy infrastructure, and other factors
- Transitioning from the existing market structure to the planned new structure is a long process, often requiring interim steps and frequent policy refinements
- Long-term objectives, however, must be certain, stable and clearly communicated in order to preserve incentives to invest and not undermine investor confidence or create stranded assets

Despite technical obstacles to LLU as a mechanism for reducing infrastructure costs and facilitating competition in fibre networks, there are other means available for regulators to mandate or encourage sharing of fibre infrastructure



# Incentivising Sharing of Fibre Infrastructure

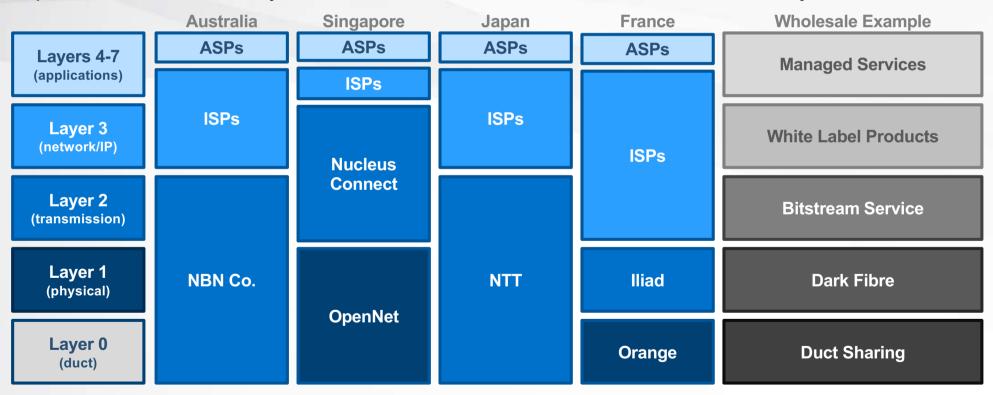
Achieving the optimal industry structure requires employing a comprehensive, harmonised approach that facilitates, encourages, and – where necessary – mandates efficient use of scarce resources without compromising competitive forces.





# Regulatory Approaches to FTTx Infrastructure

A consensus approach to managing infrastructure sharing and access in FTTx has yet to emerge amongst regulators globally; choice of model will depend on a range of factors specific to local industry structure, market conditions and market maturity.



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# Regulatory Support Overview

NGP supports operators with a comprehensive regulatory support portfolio of service offerings, from policy development and advocacy, to negotiation and execution of agreements and wholesale offerings, to implementation and operation.

#### Policy Development and Articulation

- · Spectrum, numbering and other scarce resource policies
- · Access and unbundling policies
- Dominance designations, tests of Dominance and Dominant Operator policies
- Property access policies

### **Project Management and Implementation**

- End-to-end implementation of complex, regulation-driven projects such as MNP, FNP, and CPS
- Development of supporting of RFI, RFPs and Change Requests
- Procurement and Vendor negotiations and management

#### Costing and Pricing

- Development of TD-LRIC, BU-LRIC and other comprehensive cost models
- · Costing and pricing of specific services
- Price optimisation for wholesale and interconnect services
- · Retail price regulation

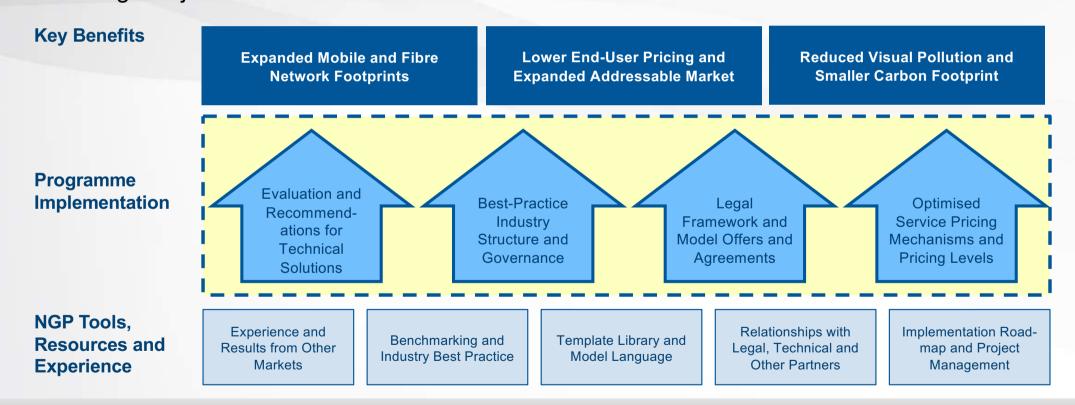
### Legal and Contractual Frameworks

- Development of Reference Interconnect and Reference Access Offers
- · Negotiation of wholesale and inter-operator agreements
- · Development of Codes of Practices
- Development of technical standards and requirements



### How NGP can assist

NGP can support the development and implementation of an effective regulatory framework that accelerates the sharing of infrastructure and enables regulators to meet multiple strategic objectives.



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# Policy Articulation and Advocacy

NGP assists operators in regulatory policy advocacy, development of consultation responses, negotiation of access and unbundling frameworks, interconnection offers and agreements, and other policy and contractual instruments.

### **Policy Development**

- Policy articulation and advocacy
- Business and organisational impact analysis
- Lobbying support
- Litigation support
- Scare resource pricing and policies

# **Execution and Compliance**

- Interconnection and Access Agreements
- Reference Offers
- Unbundling frameworks
- Infrastructure sharing agreements

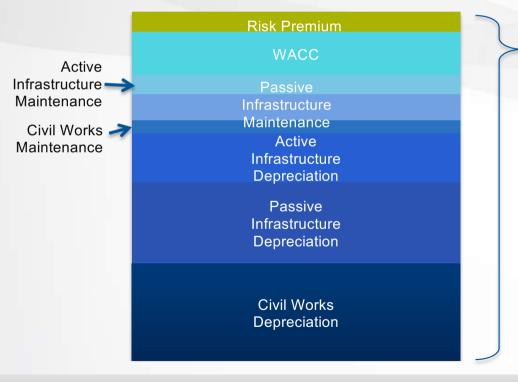
### **Policy Implementation**

- Programme Management
- Compliance audits
- Agreement implementation
- QoS/KPI reporting and monitoring



# **Pricing and Costing**

Development of credible cost models to support wholesale and retail service pricing objectives are critical to ensuring fair and effective competition and availability of affordable services across all geographic and market segments



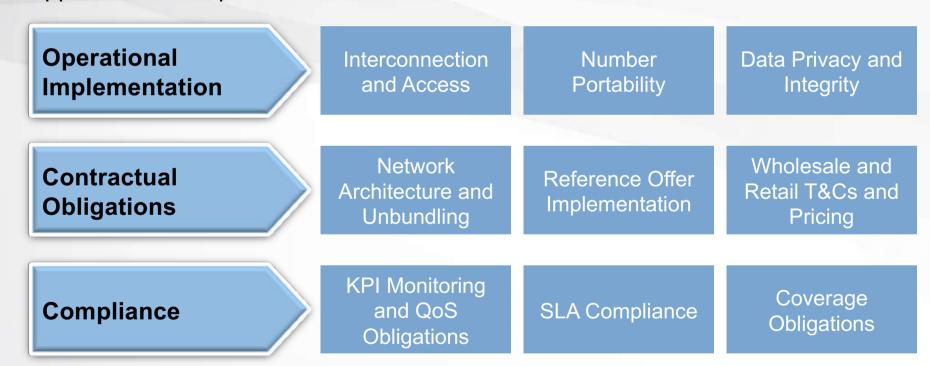
### **Service Cost Stack**

- NGP can assist with developing and defending Fully Allocated Cost (FAC), Long-Run Incremental Cost (LRIC) and other regulatory costing models.
- A credible and robust costing methodology is essential to advocating and defending wholesale and retail pricing and tariffing models, ensuring fair competition whilst preserving the incentive to invest by ensuring cost recovery.



# Programme Management and Implementation

NGP also assists clients in transforming policy directives, regulatory obligations, and regulatory-driven initiatives into smoothly performing, compliant operations through proven approaches to implementation.



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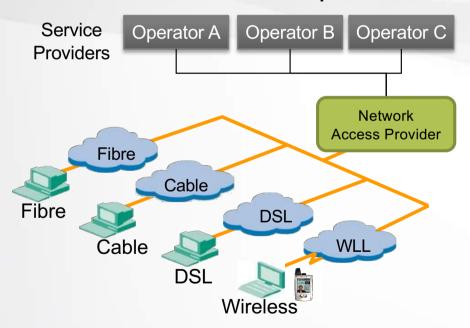


# Examples of regulatory and government projects

NGP's partners have a track record of advising national and local governments in various countries in developing policies and programs for establishing and expanding fibre

footprints.

### **Network Access Provider concept:**



### NGP Public Sector Project Examples

- Implementation of Swedish government-funded programme for allocation of subsidies for rural broadband development.
- Advising municipalities and public/private network access providers in Sweden on technical and commercial condition in order to expand affordable access and enable effective retail level competition.
- Development of wholesale access policies and pricing including cost modelling, and RIO/RAO service schedules in Jordan, Qatar and Mauritius.
- Supported development of regulatory framework for MVNOs in Jordan.
- Development and implementation of private property access policies and in-building infrastructure technical standards in Qatar.



# Fibre project examples

Through a wide range of projects in different markets, NGP and its affiliates have acquired global experience with the commercial, technical and other aspects of broadband deployment and fibre infrastructure sharing.

### Fixed Access Network strategy, Integrated Operator in Middle East

- •Strategic review of the operator's fixed network access strategy,, formulating a recommendation for its main strategic direction in this area.
- •Supported the negotiation of its fibre and duct sharing arrangements with the incumbent creating an innovative model for the sharing of infrastructure across the respective network footprints of each party

### **Duct-sharing agreement, Quad-play Operator, Qatar**

•Evaluation of options and recommendations on behalf of an incumbent broadband provider for a strategy for complying with an obligations to share its ducts, and subsequently led the negotiations that ended in the execution of a duct sharing agreement.

### Broadband feasibility and licence application, new entrant, Myanmar

- •Assisted a local conglomerate with detailed business planning, including both fibre-based and wireless access, and subsequently supported the operator's successful application for a licence to deploy these services
- •Supported the operator throughout the tender and negotiation process with network systems vendors, securing exceptionally favourable commercial and legal negotiation results.



# Mobile network sharing project examples

The mobile network sharing experience of NGP and its affiliates ranges from articulation and development of sharing polices, negotiation and execution of sharing agreements, to systems procurement, advising and managing implementation of mobile site sharing.

### Implementation of shared network for Swedish Mobile Operator

 Network systems procurement in connection with one of the first active network sharing implementation in the world, deployed in Sweden between incumbent operator and s newly-licensed operator following he 3G auction process

### **Negotiation and Implementation of Passive Network Sharing Agreement**

- Working on behalf of incumbent mobile operator in the Middle East, wed negotiated and implemented a comprehensive passive network sharing programme
- Effort also included sharing of active network elements in indoor environments

### **Programme Management of Group-wide Active Sharing Initiative**

- Working on behalf of global mobile operator with operations in 15 countries, we managed a group-wide programme to reduce network OpEx through active sharing initiatives across group markets
- Collectively, these initiatives delivered over USD 1 billion in incremental value to the group



# Mobile network sharing project examples (cont.)

Project examples (continued).

### **Tower sharing, Myanmar**

 Advising one of the major new entrants in the Myanmar mobile market on its first two tower deals to support the rollout of its mobile network rollout in Myanmar

### Shared National Broadband Network (NBN Co.), Australia

- Advising NBN Co (the entity that will operate the A\$49 billion National Broadband Network), on:
- NBN Co's development of its Wholesale Broadband Agreement (WBA), which set outs the commercial terms on which NBN Co will supply Layer 2 wholesale bitstream services to its wholesale customers
- Securing the approval of NBN Co's special access undertaking, the world's first long term framework for the economic regulation of wholesale access to super-fast broadband services

### **Mobile Operator, South Africa**

- Assisting a South African Mobile Operator in successfully advocating favourable sharing policies
- Effort resulted in adoption of 'sharing-friendly' regulatory framework and reduced client OpEx



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# **Introducing Netcom Global Partners**

Netcom Global Partners ("NGP") is a global consultancy providing telecommunications sector clients expert advice and support on strategy, technology, operational and other issues, enabling clients to profitably compete and grow their businesses.

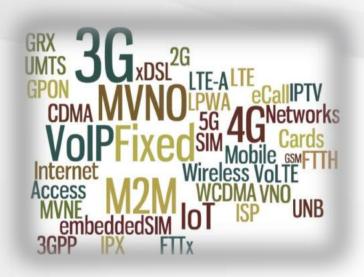


- The collective telecom expertise of our team of advisors, all specialists in their field, sets us apart as consulting partner to progressive telecom companies worldwide
- Our teams are engaged in projects worldwide, primarily in Scandinavia, Europe, Asia, Africa and Latin America.
- The global reach of our partnership creates the foundation for an international perspective and cross-cultural understanding of market and organisational issues
- As a specialised consultancy, with an in-depth understanding of our market niche, Netcom Global Partners is a responsive and flexible partner for the most demanding clients



### Service overview

Based on our extensive experience in design, deployment and operation of telecommunications services, we help clients converting business ideas and technologies into successful products and services.



### Market and business planning

- Providing effective market strategies and business plans
   Network sharing, interconnection and regulatory related issues
- Providing expert advisory services in connection with network sharing opportunities, licence award processes, spectrum auctions, interconnection and access, and other regulatory issues.

### Network planning, design and deployment

- Supporting procurement and deployment of networks, systems and infrastructure
- Network planning and design, review/audit and optimisation
   Service development & product management
- Managing development and launch of innovative and profitable services
   Organisation and operations
- Assisting telecommunications operators in improving operational performance and efficiency



# Our expertise and capabilities

We provide advisory and management expertise in planning, design, deployment and operation of telecom networks and services.

### Some project examples:

- · Operational reviews and audits
- · Market opportunity evaluations
- · Network planning and design
- Managed Services feasibility reviews
- · Indoor coverage solutions
- · Network consolidation strategy definition
- Market entry consultancy services for mobile operators and service providers
- · License acquisition support / spectrum valuation
- Interconnection, access and wholesale agreements
- Roaming and clearing audits commercial and technical
- Regulatory, standardisation issues, network numbering
- Number portability implementations (mobile/fixed)
- Fibre rollout, fibre unbundling and fibre sharing and access

- M2M/IoT technologies, solutions and concepts
- · Operational KPI benchmarking Service feasibility studies
- Customer Experience management
- · Project portfolio and governance strategy
- Project Management Office (PMO) implementation
- Management of service launch and transition projects.
   Some recent examples: VoLTE, MVNO
- Network procurement RAN, Core
- Project management of mobile and fixed broadband network roll-out
- IMS Migration projects
- Power solutions, "Green Connectivity"
- · Commercial and technical due diligence
- Tower, Network and Infrastructure Sharing agreements and implementation



# Our global experience

Our partners, coming from leading telecom operators, vendors and consultancies, bring experience from work with clients in a wide range of countries and regions with different

market and regulatory conditions.



### Some clients our partners have worked for:

<ul> <li>Amara</li> </ul>	Communicat	ions
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- Axiata
- Bell Canada
- Batelco
- CellularOne
- Canadian Imperial Bank
   of Commerce
- Digicel
- Du
- Emtel
- Ericsson
- FarEasTone
- Hi3G / 3
- 3GIS
- ICE / Net1
- · Intelig, Brazil
- Meteor
- Mobifone

- Mobtel
- Nokia Networks
- Orange / Getesa
- Orange / Jordan
- Orange /Switzerland
- Umniah / Jordan
- Orascom Telecom (now Global Telecom Holding / Vimpelcom)
- Ooredoo Group
- OnePhone
- Sabafon
- SmarTone
- Smart Philippines
- Sumitomo Group
- Swedish Post and Telecom Authority
- TALTDC
- Telefonica

- Tele2
- Telenor
- TeliaSonera
- Telkomsel
- Teracom
- · T-Mobile / Germany
- T-Mobile /Poland
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- TIM Brazil
- Turkcell
- Viettel
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