

## Basic Connectivity Requirements



# DIGITAL OXYGEN

Management Consultants Commercial Preferences

### Device Deployment / Location

- Mobile
- Fixed Location
- Deployment Deep Within Structures

▲ Available Power Supply

- Fixed Power Supply
- Battery (Chargeable)
- Battery (Non-Chargeable)

### ▲ Processing Capabilities

Low Processing Power (e.g. Sensors)

High Processing Power

Depending on your use case, it is important to know if e.g. pre-processing or storing of data can be done on-device.

- ▲ **Product Horizon**
  - Short-Term Connectivity
  - Long-Term / Future-Proof

Being ready for technology changes is essential, especially for connecting M2M IoT devices, as they are usually much longer in use than consumer devices.

# Mobile Connectivity Canvas

## The Crucial Dimensions of Mobile Connectivity

April 2021 | Axel Meiling, Tobias Woldrich, Katharina Finke

**Digital Oxygen** is a management consultancy based in Munich, Germany, with a focus on digital transformation and digital product development in the fields of telecommunication, media, and digital healthcare. World-wide, clients trust us with their strategic challenges: From value proposition development and digital product development to launch. From start-up to multinational enterprise.

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Stating the Obvious

# Mobile Connectivity Is Complex and Everyone Struggles

In more than 20 years of handling mobile connectivity projects, products, and strategies, basically each project had two things in common:

- **Everyone** dealing with mobile connectivity **struggles somehow**.
- **Everyone underestimates the complexity** of mobile connectivity initially.

In this article, my colleagues and I want to shed some light on the complexity of mobile connectivity – and propose a **Mobile Connectivity Canvas** to structure and relieve some of your mobile connectivity pains.

## Who Should Care About “Mobile Connectivity”?

- 1) **Optimizing Existing Connectivity:** Everyone who **already relies on mobile connectivity** for – let’s say – **1,000 or more connected devices** like smartphones, IoT devices, or cars, somehow struggles with one of the following issues:

- **Connectivity Costs:** That is when the famous “bill shock” hits you every single month: You know you have unfavorable connectivity terms or your connectivity costs are simply untransparent.
- **Operator Lock-In or Dependencies:** Switching operators can seem impossible – for example when the costs for switching SIM cards are already higher than the connectivity cost savings.
- **Device Management:** There are plenty of issues that can arise when you manage a large number of connected devices: Starting with replacing a lost phone (and its connectivity) to providing affordable connectivity to a travelling employee.
- **Connectivity Quality and/or Coverage:** Especially if you rely on global connectivity, patchy network quality and coverage will be quite familiar – and a problem if you need reliable, high quality connectivity for your customers, devices, cars, or employees.
- **Regulatory Restrictions:** China is not a fan of the eSIM, Brazil and many others don’t like permanent roaming, lots of European countries have very strict KYC requirements: Regulation is messy.

As a result, lots of companies usually face a daily, frustrating struggle to **change anything** about their existing connectivity solution.

- 2) **Getting Started with Connectivity:** Then there are cases, where your challenge is to connect devices, but you simply **do not know where to start**. For example:

- You want to provide connectivity to **employees** (“Enterprise Connectivity”).
- You need to connect your **IoT devices** (from cars and smoke detectors to consumer IoT like the Apple Watch or other smart watches).
- You need to connect your **factories** (smart or not, via “Campus Networks”).
- You want to offer **connectivity as a service** (like “end-user data plans”).

## A Big Word: Mobile Connectivity Strategy

Of course: A consultancy proposes a **strategy**, right? Not really – we just urge you to **make a plan** when it comes to your mobile connectivity. Whether you call it a “strategy”, a “roadmap”, or a “project plan”: Who cares. But it saves you a ton of money, lifetime, pivots, negotiations, and nerves if you **ask and answer the right questions** upfront.

# Mobile Connectivity Canvas

The Crucial Dimensions of Any Mobile Connectivity Strategy

## Basic Connectivity Requirements

Type of Connectivity

M2M IoT

Mobile Consumer IoT

Human Connectivity

Mobile Consumer IoT: The end user manages and pays for the connectivity of their consumer IoT device. This device has the potential of this still-untapped market.

Supported Devices

Smartphones

Tablets

Industrial IoT Devices

Consumer IoT Devices

Vehicles

Industrial IoT ranges from heavy machinery to smoke detectors. Consumer devices like the Apple Watch are included in "consumer IoT".

Services

Voice

Data

Text Messages

Geography

Local

National

Multi-National

Global

Cross-Border Usage

Device Deployment / Location

Mobile

Fixed Location

Deployment Deep Within Structures

Available Power Supply

Fixed Power Supply

Battery (Chargeable)

Battery (Non-Chargeable)

Connectivity Priorities

Speed

Costs

Coverage

Latency

Backhaul

Quality (Reliability/Quality)

Security

Technology Support

3G/3G+/4G

LTE-M

Narrowband IoT

5G

Private Networks

And a variety of more technology options.

SIM Card Technology

Physical SIM Card

eSIM

SIM (Upcoming)

Connectivity Usage

Bootstrap

Scheduled/Triggered

Active/Permanent Connectivity

How you use your connectivity will affect the conditions and conditions offered by connectivity providers and also have regulatory implications.

Processing Capabilities

Low Processing Power (e.g. Sensors)

High Processing Power

Depending on your use case, it is important to know if you are processing or storing of data can be done on-device.

## Product And Usage Requirements

Target Users

B2C End Users

B2B End Users

M2M End Users

"B2B End Users": Many connectivity solutions target B2B end users. In this case, more than multiple, even 1000s of end users.

Target User Pain Points

Irrespective of any desired requirements, what are the pain points that you are aiming to solve for your end users, their clients, or your own business?

Target Connectivity Experience

How much you know about the experience you want to provide or support with connectivity, the easier it will be to make it happen.

Personalization Requirements

Are there any personalization requirements for your device and their connectivity? E.g. the need for personalization and connectivity to ensure the identity of a certain device?

Forecast

User Base Development

Service Consumption

Revenue Projection

On-Device Branding

Name

Owner

Connectivity Provider

White Label

If you want your own branding or even sell your connectivity directly, you will need your own eSIM, OEM relations, and go-to-market timeline.

Product Horizon

Short-Term Connectivity

Long-Term / Future Proof

Being ready for technology changes is essential, especially for connecting IoT devices, as they are usually much longer-lived than consumer devices.

## Business Requirements

Connectivity Objective

Revenue Increase / Connection

Add / Launch Connectivity Proposition

Extend Customer Base

Increase Connectivity Quality

Enable Revenue With Connectivity

Cost Reduction

Connectivity Cost Reduction

Infrastructure And Service Cost Reduction

Process Cost Reduction

Increase Negotiation Power

Enable Cost Savings With Connectivity

There are plenty of reasons to want connectivity, but mostly they boil down to enabling an existing product or service to further increase.

Commercial Preferences

Upfront Investment (CAPEX)

Operational Costs (OPEX)

Flexibility Preferences

Contract Duration

Connectivity Provider Independence

Technology Provider Independence

Regulation

KYC

Data Privacy

Registration And Certification

Permanent Roaming

Country-Specific Regulation

Number Portability

Emergency Calling

Lawful Interception

Importantly for global connectivity, regulation might cause some headache. China doesn't like the eSIM. Brazil doesn't like permanent roaming. KYC is especially strict in Germany.

Connectivity Business Model

Use Connectivity Yourself (Enabler)

Sell Own Connectivity Offer

Retail Others' Offers

Enable Others To Sell Connectivity

Connectivity Revenue Streams

No Direct Connectivity Revenues

Pre-Paid

Post-Paid

Revenue Share

Connectivity Risk Margin

Recurring Service Fees

You can create revenues from more than just the connectivity itself. E.g. as an MNO or MNC.

End-User Connectivity Pricing

Free / Own Connectivity Usage

Local Connectivity Pricing

Price Breaker

Premium

## Implementation Conditions

Budget Constraints

Proof of Concept

Setup

Operations of Connectivity Solution

Connectivity Costs

Customer Acquisition Costs

Project Priority

High Strategic Importance

Unclear / In Evaluation

Low Priority

Existing Connectivity Solution

Already supported services

Existing connectivity infrastructure

Current Cost Structure

Timeline of Existing Contracts

Time-To-Market Requirements

Target Timeline For Proof of Concept

Target Timeline For Commercial Launch

Existing Resources And Assets

Project And Vendor Management

App Development

Technical Integration

Maintenance

End User Support

Existing Relations

Integration Partners

MNOs / MVNOs / MNCs

Connectivity Hardware OEMs

RSP Vendors

Connectivity Management Providers

Regulators (CCMA, ITN)

For landscapes of members in the field of eSIM connectivity and mobile IoT connectivity, visit [www.digital-oxygen.com/connections](http://www.digital-oxygen.com/connections).

Control of Connectivity Chain

Name

SIM Card / eUICC

SIM Profiles

SIM Profiles

Connectivity Hardware (Modules)

Devices To Connect

RSP Solution

MCC / MNC And MNCs

Cores (GSM, HSPA, 4G, 5G)

How many you are in control of different components in the connectivity chain, the more flexibility you have from cherry-picking between available connectivity options.

Connectivity Decisions You Have To Make

Important Information You Need To Gather

Connectivity Priorities You Have To Define

Implementation Conditions You Need To Consider

The Digital Oxygen Mobile Connectivity Canvas structures the complex set of questions, decisions, and information as a starting point for any mobile connectivity strategy. Each dimension will influence the architecture, technical requirements, the partner selection, economic feasibility, time-to-market, and required effort for your connectivity solution.

[www.digital-oxygen.com/connectivity](http://www.digital-oxygen.com/connectivity)

# The Mobile Connectivity Canvas

## Connectivity Is Complex – Not Complicated

With this Mobile Connectivity Canvas, we take a step back and take inventory of all **issues, questions, decisions**, and required **information** you need to have on your list. It is a guide to clear the first hurdle towards your individual connectivity strategy by breaking down a complex topic into 34 manageable chunks and four main categories:

- **Basic Connectivity** Requirements
- **Product And Usage** Requirements
- **Business** Requirements
- **Implementation** Conditions

You can **download** the Mobile Connectivity Canvas for free at [www.digital-oxygen.com](http://www.digital-oxygen.com)

## Basic Connectivity Requirements

Type of Connectivity

Supported Devices

Services

Geography

Device Deployment And Location

Available Power Supply

Connectivity Priorities

Technology Support

SIM Card Technology

Connectivity Usage

Processing Capabilities

## Product And Usage Requirements

Target Users

Onboarding Experience

On-Device Branding

Product Horizon

Target User Pain Points

Target Connectivity Experience

Personalization Requirements

Forecast

## Business Requirements

Connectivity Objective

Connectivity Business Model

Connectivity Revenue Streams

End-User Connectivity Pricing

Commercial Preferences

Flexibility Preferences

Regulation

Infrastructure Ownership

## Implementation Conditions

Budget Constraints

Time-To-Market Requirements

Existing Resources And Assets

Existing Relations

Project Priority

Existing Connectivity Solution

Control of Connectivity Chain

## Structure of the Mobile Connectivity Canvas

## Module 1: Basic Connectivity Requirements



### Laying the Groundwork for Your Connectivity Strategy

In this module, you mostly need to make decisions regarding your **connectivity use case** and the underlying **technical requirements**: Which devices are you aiming to connect: Are we talking about industrial IoT, mobile consumer IoT (like the Apple Watch), consumer connectivity devices (like iPhones), or cars? Where and how are you going to deploy these devices? What do you care about most: Connectivity prices, quality, or coverage? And many more:



### Deep Dive: SIM Card Technology

Each of these criteria has implications. For example: What does it matter if I want to use physical (plastic) SIM cards or eSIMs for my connectivity?

	Physical SIM Card	eSIM
<b>Onboarding Experience</b>	Delivery of a plastic SIM card via mail – no way around that.	Multiple “onboarding” options: From scanning a QR code to an entirely digital experience without killing a single tree.
<b>Infrastructure</b>		You need an SM-DP+ or SM-DP and SM-SR for the management of eSIMs. That is another partner you have to take into account.
<b>Supported Devices</b>	With regards to consumer devices, most of them still have a physical SIM slot.	The eSIM reaches more and more smart-phones, but still, you are limiting yourself to a small subset of iOS and Android eSIM devices.
<b>Operator Dependency</b>	If you want to switch operators, you switch the SIM card – that can be a costly and logistical challenge. Sending 10,000 letters with SIM cards is one thing. But it is a different effort if you have to cut into each of your money transporters with a cutting torch to reach the highly secured SIM card.	The eSIM makes operator switching much easier – it is still not entirely “free”, but it is much easier to distribute new eSIM profiles over-the-air to your customers or employees.

**Any many more implications...**









### Implications of SIM Card Technology on Connectivity Solution

## Module 2: **Product and Usage Requirements**

### Solving Pain Points and Shaping User Experience



In this dimension, you should get a clear picture of which connectivity experience and product you want to offer: **Connectivity is not (only) a shiny product for you to advertise on your website but solves a very specific set of pain points for you and your users.** For that purpose, you need to define your target users or devices, understand their usage context and challenges, and think about your connectivity lifecycle from onboarding over management to shut down.

-  Target Users
-  Onboarding Experience
-  On-Device Branding
-  Target User Pain Points
-  Target Connectivity Experience
-  Personalization Requirements
-  Forecast
-  Product Horizon

### Deep Dive: Branding

Let's go down the rabbit hole again for one of these criteria: Why does "Connectivity Branding" matter? Assuming we want to launch our own "Digital Oxygen" connectivity offer for our team and care a lot about branding: We want to see "DiOx" as the service provider name (SPN) in the upper left corner of the phone.

Some Implications of On-Device Connectivity Branding	
<b>SIM/eSIM Vendor</b>	The branding needs to be configured in the SIM profile template. If we use plastic SIM cards, we need to define a design that is printed on the SIM card.
<b>OEM Relations</b>	That is a fun one: If you want to see "DiOx" in really all interfaces of your smartphone (like in settings or during installation of an eSIM profile), you will not get around a contract with the major smartphone OS OEMs like Apple or Google.
<b>Timeline</b>	Compared to non-branded connectivity, the above changes will certainly have an impact on your time-to-market - of up to 9 months.
<b>And many more implications...</b>	









#### Implications of On-Device Branding on Connectivity Solution

## Module 3: **Business Requirements**



### Let's Talk Money, Strategic Goals, and Regulation

This section is all about your **business goals and requirements**: Why do you care about connectivity? Do you need to reduce connectivity cost or increase your revenues from or through connectivity? How important is it for you to own all your telco infrastructure or are you happy to have somebody else run it?

-  Connectivity Objective
-  Commercial Preferences
-  Connectivity Business Model
-  Flexibility Preferences
-  Connectivity Revenue Streams
-  Regulation
-  End-User Connectivity Pricing
-  Infrastructure Ownership

### Deep Dive: Regulation

Especially regulation can cause some serious headache when you are trying to implement a connectivity solution across multiple countries.

Deployment Region	Regulatory Implication
China	Does not support the eSIM (but are developing their own solution).
Brazil (and others)	Do not allow permanent roaming.
Germany (and others)	Ask for strong KYC (Know-Your-Customer) identification.
Most Countries	Do not have VoLTE Roaming implemented, so your Apple Watch will not work when roaming.

**And many more regulatory surprises like the right for number portability or the need to support emergency calling.**








#### Regulatory Implications of Connectivity Deployment Region

## Module 4: Implementation Conditions



### Assessing Internal Resources and Capabilities

That is your reality check: This dimension aims at understanding the **budget, assets, tools, and prerequisites** that you have at hand to implement your individual connectivity solution. Do you already have existing resources and assets that you can build upon? What is the budget and timeframe for implementation? And have you already established useful business relations with partners and vendors?

- |   |  |
|---|--|
|  Budget Constraints            |  Project Priority               |
|  Time-To-Market Requirements   |  Existing Connectivity Solution |
|  Existing Resources and Assets |  Control of Connectivity Chain  |
|  Existing Relations            |  |

### Deep Dive: Control of Connectivity Chain

Let's say you are a car manufacturer and want to connect your cars. Depending on how much of the connectivity chain you can control, your options and flexibility will increase – let's explore the example of operator dependency:

If You Control	That Means
only the SIM card in the car	you control the <b>operator that provides connectivity</b> and can <b>switch SIM</b> cards, e.g. to optimize costs.
the SM-SR that serves your SIM profiles	you can automatically push new eSIM profiles to the car, e.g. to use a cheaper operator when travelling between countries.
the connectivity module and the software on it	you have a whole new set of options: You can e.g. use the <b>eSIM consumer standard</b> (instead of the M2M), which will save you quite some hassle for operator integrations.
And many other implications when you control e.g. one or multiple PGWs or SIM applets.	

#### Implications of Connectivity Chain Control on Operator Dependency

Wrap Up

## 1,000 Connectivity Questions and 1 Honest Answer

**In a nutshell:** There is a lot to consider when finding the path to your perfect connectivity solution. As you can see, there are probably 1,000 perfectly valid questions around connectivity – with just one honest answer: **It depends.** On your connectivity use case(s), your business goals, and the preconditions. But you have to start somewhere – and hopefully this Canvas makes the start a bit easier.

## About the Authors



Axel has 20 years of experience in the Telco and IoT industry, has seen connectivity projects from every angle, and has a profound understanding of **all relevant technical solutions to connect devices**. He has led countless connectivity projects – for international M(V)NOs, OEMs and IoT vendors – and knows all the pitfalls, shortcuts, and success factors to guide enterprises towards a tailor-made connectivity solution.

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Tobias has built several MVNOs from scratch and is an expert in **selecting, evaluating, and onboarding suitable connectivity partners** and vendors. He has a unique expertise in the development of user-centric value propositions from architecture to launch and beyond.

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Katharina has hands-on experience in developing **cloud telco and local breakout solutions** – from mapping out initial requirements and characteristics, defining technical architecture and solution design, to project planning and actual implementation.

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