Contents

Mercosur automotive & supplier market overview ................................................................. 8
  Mercosur and recent actions .......................................................................................... 8
  Large variances among Mercosur economies ................................................................. 9
  FDI has grown significantly .......................................................................................... 11
  Varying automotive industries ...................................................................................... 12
  Vehicle ownership growing slowly ................................................................................ 13
  European and US carmakers dominate mercosur markets .............................................. 14
  Not a major vehicle export market ................................................................................ 17
  Will vehicle production spur supplier chain growth? .................................................... 18
  Emissions and vehicle safety issues slowly being addressed ......................................... 19
  Mixed outlook .............................................................................................................. 20

Argentina automotive industry overview ........................................................................ 22
  Overview of macro economic situation ....................................................................... 22
  Planned investment in infrastructure development projects ......................................... 24
  National automotive policy & plans ............................................................................. 25
  Tax structure ................................................................................................................ 27
  Non-tariff trade barriers ............................................................................................... 28
  Emissions & safety regulations ...................................................................................... 29
  Manufacturing advantage ............................................................................................. 30
  Overview of automotive industry & supply chain ......................................................... 31
  Structure of automotive industry .................................................................................. 32
  Production in 2013 & forecasts ..................................................................................... 34

Export destinations & trends ............................................................................................ 35
  Manufacturing presence of OEMs & production bases .................................................. 37
  Investments by OEMS .................................................................................................. 39

Overview of vehicle component industry ........................................................................ 39
  Investments by vehicle component suppliers ............................................................... 41

OEM supplier relationship ............................................................................................... 42
  Localisation trends ........................................................................................................ 42
  Cluster development ..................................................................................................... 43
  Location of carmakers in Argentina .............................................................................. 44
  R&D capabilities .......................................................................................................... 44
  Who Supplies Whom .................................................................................................... 45

Opportunities, challenges & future outlook ..................................................................... 45

Brazilian Automotive Industry Overview ........................................................................ 47
  Overview of macro economic situation ....................................................................... 47
  Planned investment in infrastructure development projects ......................................... 49
  National automotive policy & plans ............................................................................. 50
  Tax structure ................................................................................................................ 53
  Non-tariff trade barriers ............................................................................................... 56
## Table of Contents

**Emissions & safety regulations** ................................................................. 56
**Manufacturing advantage** ................................................................. 58

### Overview of Automotive Industry & Supply Chain ............................................. 61
- **Structure of Automotive Industry** ........................................... 62
- **Production in 2013 & forecasts** ........................................ 65
- **Export Destinations & Trends** ........................................... 66
- **Manufacturing Presence of OEMs & production bases** ........ 69
- **Investments by OEMs** ......................................................... 71

### Overview of Vehicle Component Industry ...................................................... 73
- **Investments by Vehicle Component Suppliers** ...................... 76
- **List of Joint-Ventures and Mergers and Acquisitions 2012/2013** .... 77

### OEM Supplier Relationship ........................................................................ 77
- **Involvement of automakers in supplier development** .......... 78
- **Localisation Trends** ............................................................... 78
- **Cluster Development** ............................................................. 79
- **R&D Capabilities** ................................................................. 81

### Who Supplies Whom ..................................................................................... 82

### Opportunities, Challenges & Future Outlook ................................................. 83

### Supplier Profiles ........................................................................................... 85

#### Argentina ....................................................................................................... 85
- Affinia Argentina ................................................................. 85
- Albano Cozzuol ................................................................. 89
- Autobat ................................................................................ 92
- Basso .................................................................................. 95
- Baterias Argentina ............................................................ 99
- Corven .............................................................................. 102
- Establecimientos Gamar .................................................... 106
- Establecimientos Romet .................................................... 109
- Famar Fueguina ................................................................. 112
- Fate .................................................................................. 115
- Fras-Le .............................................................................. 119
- Fric-Rot ............................................................................ 123
- GN Group ........................................................................ 126
- Industrias Guidi ................................................................. 129
- L’Equipe Moniteur ............................................................. 132
- MA Automotive ................................................................. 136
- Master Trim de Argentina .................................................. 139
- Maxion Montichi ............................................................... 142
- MGI Coutier ..................................................................... 146
- MIRGAR Group ................................................................. 149
- Pertrak .............................................................................. 153
- Plascar ............................................................................... 156
- PST Electrônica ................................................................. 162
- Restores Argentina ............................................................ 166
- Sintercal ........................................................................... 169
- Taranto ............................................................................. 172
- Tenaris Siderca ................................................................. 176
- Unionbat .......................................................................... 180
- Ventalum ......................................................................... 183
- VMG ................................................................................. 186

#### Brazil ........................................................................................................... 189
- Acumuladores Moura .......................................................... 189
- Aethra Sistemas Automotivos ............................................. 193
<table>
<thead>
<tr>
<th>Company Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aisin do Brasil</td>
<td>199</td>
</tr>
<tr>
<td>Aunde Brasil</td>
<td>203</td>
</tr>
<tr>
<td>Autometal</td>
<td>206</td>
</tr>
<tr>
<td>Automotiva Usiminas</td>
<td>214</td>
</tr>
<tr>
<td>Beekaert do Brasil</td>
<td>218</td>
</tr>
<tr>
<td>Borrracas Vipal</td>
<td>222</td>
</tr>
<tr>
<td>Chris Cintos de Segurança</td>
<td>226</td>
</tr>
<tr>
<td>Cinpal</td>
<td>229</td>
</tr>
<tr>
<td>Continental Group</td>
<td>232</td>
</tr>
<tr>
<td>Delga Indústria e Comércio</td>
<td>237</td>
</tr>
<tr>
<td>DHB Componentes Automotivos</td>
<td>241</td>
</tr>
<tr>
<td>Fabricas Nacional de Instrumentos</td>
<td>245</td>
</tr>
<tr>
<td>Fibam Companhia Industrial</td>
<td>248</td>
</tr>
<tr>
<td>Fras-Le</td>
<td>252</td>
</tr>
<tr>
<td>Freios Controi</td>
<td>257</td>
</tr>
<tr>
<td>Fundiçao Tupy</td>
<td>261</td>
</tr>
<tr>
<td>Hysung do Brasil</td>
<td>265</td>
</tr>
<tr>
<td>Industias Arteb</td>
<td>268</td>
</tr>
<tr>
<td>Iochpe-Moxion</td>
<td>272</td>
</tr>
<tr>
<td>Jardim Sistemas</td>
<td>281</td>
</tr>
<tr>
<td>Keiper do Brasil</td>
<td>285</td>
</tr>
<tr>
<td>Magna Seating</td>
<td>288</td>
</tr>
<tr>
<td>Mahle Behr</td>
<td>292</td>
</tr>
<tr>
<td>Mahle Metal Leve</td>
<td>297</td>
</tr>
<tr>
<td>Mangels Industrial</td>
<td>303</td>
</tr>
<tr>
<td>Maxion Componentes Estruturais</td>
<td>307</td>
</tr>
<tr>
<td>Maxion Wheels</td>
<td>313</td>
</tr>
<tr>
<td>Nemak Aluminio do Brasil</td>
<td>320</td>
</tr>
<tr>
<td>NFP Automotive</td>
<td>324</td>
</tr>
<tr>
<td>NSK Brasil</td>
<td>327</td>
</tr>
<tr>
<td>NTN do Brasil</td>
<td>330</td>
</tr>
<tr>
<td>Pirelli Pneus</td>
<td>332</td>
</tr>
<tr>
<td>Plascar</td>
<td>336</td>
</tr>
<tr>
<td>Plastixc Omnium</td>
<td>342</td>
</tr>
<tr>
<td>Proema Automotiva</td>
<td>346</td>
</tr>
<tr>
<td>PST Electôntica</td>
<td>349</td>
</tr>
<tr>
<td>Randon</td>
<td>353</td>
</tr>
<tr>
<td>Rassini NH-K</td>
<td>359</td>
</tr>
<tr>
<td>Romi</td>
<td>363</td>
</tr>
<tr>
<td>Saint-Gobain Sekurit Brasil</td>
<td>367</td>
</tr>
<tr>
<td>Sifco S.A.</td>
<td>371</td>
</tr>
<tr>
<td>Sociedade Fabricante de Pecas (Sofape)</td>
<td>376</td>
</tr>
<tr>
<td>Soplast</td>
<td>378</td>
</tr>
<tr>
<td>Suspensys Sistemas Automotivos</td>
<td>381</td>
</tr>
<tr>
<td>Takata Brasil</td>
<td>385</td>
</tr>
<tr>
<td>ThyssenKrupp Group</td>
<td>389</td>
</tr>
<tr>
<td>TMD FRictiondo Brasil</td>
<td>394</td>
</tr>
<tr>
<td>Tower Automotive do Brasil</td>
<td>398</td>
</tr>
<tr>
<td>Trelleborg Vibracoustic do Brasil</td>
<td>402</td>
</tr>
<tr>
<td>TRW Automotive</td>
<td>406</td>
</tr>
<tr>
<td>Valeo Sistemas Automotivos</td>
<td>412</td>
</tr>
<tr>
<td>Vibracoustic do Brasil</td>
<td>417</td>
</tr>
<tr>
<td>Visteon Sistemas Automotivos</td>
<td>419</td>
</tr>
<tr>
<td>WHB</td>
<td>423</td>
</tr>
</tbody>
</table>
**Local operations of major suppliers**

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASF</td>
<td>460</td>
</tr>
<tr>
<td>Brembo</td>
<td>461</td>
</tr>
<tr>
<td>Dana Argentina S.A.</td>
<td>462</td>
</tr>
<tr>
<td>Denso Manufacturing Argentina S.A.</td>
<td>463</td>
</tr>
<tr>
<td>Faurecia</td>
<td>464</td>
</tr>
<tr>
<td>Faurecia Automotive del Uruguay S.A.</td>
<td>467</td>
</tr>
<tr>
<td>Gestamp</td>
<td>470</td>
</tr>
<tr>
<td>GKN Sinter Metals de Argentina S.A.</td>
<td>473</td>
</tr>
<tr>
<td>Johnson Controls Automotive Systems</td>
<td>474</td>
</tr>
<tr>
<td>S.R.L.</td>
<td>474</td>
</tr>
<tr>
<td>JTEKT</td>
<td>477</td>
</tr>
<tr>
<td>Manga Seating Argentina S.A.</td>
<td>478</td>
</tr>
<tr>
<td>Mahle Argentina</td>
<td>481</td>
</tr>
<tr>
<td>Metalsa</td>
<td>484</td>
</tr>
<tr>
<td>Pilkington Automotive Argentina SA</td>
<td>485</td>
</tr>
<tr>
<td>PPG Industries Argentina S.A.</td>
<td>486</td>
</tr>
<tr>
<td>Saint-Gobain Argentina S.A.</td>
<td>489</td>
</tr>
<tr>
<td>SKF</td>
<td>491</td>
</tr>
<tr>
<td>Sogefi</td>
<td>492</td>
</tr>
<tr>
<td>Visteon Argentina S.A.</td>
<td>493</td>
</tr>
<tr>
<td>Yazaki International Corporation Argentina S.R.L.</td>
<td>496</td>
</tr>
<tr>
<td>Yazaki Uruguay S.A.</td>
<td>497</td>
</tr>
<tr>
<td>ZF Argentina S.A.</td>
<td>498</td>
</tr>
</tbody>
</table>

**Figures**

- Figure 1: Mercosur: Exports by Trading Bloc (USD million) ......................................................... 9
- Figure 2: GDP Growth Rates for Mercosur Member Countries (%) ....................................................... 10
- Figure 3: Mercosur: Net FDI Inflows (USD million) .............................................................................. 11
- Figure 4: Vehicle Production Argentina, Brazil and Venezuela (units) ................................................. 13
- Figure 5: Mercosur Market Share by Vehicle Sales (units sold in 2012) ............................................. 15
- Figure 6: Argentina & Brazil: Imported Car Registrations as a Percentage of Total New Car Registrations 17
- Figure 7: Vehicle Production (units) & Export (%) for Argentina and Brazil ....................................... 18
- Figure 8: Brazil & Argentina Vehicle Production Forecast (2011–2017) ........................................... 21
- Figure 9: Uruguay & Venezuela Vehicle Production Forecast (2011–2017) .......................................... 21
- Figure 10: Argentina GDP Growth (%) .............................................................................................. 22
- Figure 11: Argentinian Peso vs. US dollar Average Annual Exchange Rate ......................................... 24
- Figure 12: Argentina Domestic Vehicle Sales (Domestic vs. Imports) .............................................. 26
- Figure 13: Argentina GDP per capita (USD) ......................................................................................... 28
- Figure 14: Argentina Deaths By Road User Category (2010) ............................................................. 30
- Figure 15: Argentina Vehicle Sales by Carmaker (2013) ................................................................... 33
Figure 16: Argentina Vehicle Sales by Segment (2012) ................................................................. 33
Figure 17: Argentina Vehicle Production by Carmaker (units) ....................................................... 34
Figure 18: Argentina Vehicle Production, Sales & Exports (units) .................................................. 35
Figure 19: Argentina Vehicle Exports by Destination (2013) .......................................................... 35
Figure 20: Argentina Vehicle Imports by Source (2012) ................................................................. 36
Figure 21: Argentina: Vehicle Export Destination by Carmaker (2012) ......................................... 36
Figure 22: Argentina Vehicle Exports by Type (2013) .................................................................... 37
Figure 23: Argentina Automotive Production by Carmaker (2013) ................................................. 38
Figure 24: Argentina Automotive Parts Imports by Source (2012) .................................................. 40
Figure 25: Argentina’s automotive clusters .................................................................................... 44
Figure 26: Argentina Passenger Car & Light Vehicle Production Forecast (units) ......................... 46
Figure 27: Brazil GDP Growth (%) ............................................................................................... 47
Figure 28: Brazil Average Annual Selic Interest Rates ................................................................. 48
Figure 29: Brazil Imported Car Registrations as a Percentage of Total New Car Registrations .... 51
Figure 30: Brazil Car Imports by Origin (2012) ............................................................................. 52
Figure 31: Vehicle imports by Abeiva members (2012) ................................................................. 53
Figure 32: Brazil New Car Registration by Fuel Type ................................................................. 57
Figure 33: Brazil Deaths by Road User Categories (2009) .......................................................... 58
Figure 34: Brazil Unemployment rate (% of total labour force) .................................................. 59
Figure 35: Brazil FDI net inflows (USD billion) .......................................................................... 60
Figure 36: Brazil FDI by Country (2010) ..................................................................................... 60
Figure 37: Brazil New Passenger Car Registrations by Carmaker (2012) .................................... 61
Figure 38: Brazil Investments in the Automotive Industry (USDm) .............................................. 62
Figure 39: Brazil 2012 Vehicle Sales by Carmaker (units) ............................................................ 64
Figure 40: Brazil Passenger Car Sales by Segment (2012) .......................................................... 64
Figure 41: Brazil Passenger Car Registrations (units) .................................................................. 65
Figure 42: Brazil Automotive Production by Vehicle Type (2012) ............................................. 66
Figure 43: Brazil Automotive Industry Overview (units) ............................................................. 66
Figure 44: Brazil Total Vehicle Exports (units) ............................................................................. 67
Figure 45: Brazil Vehicle Exports by Country (2012) .................................................................. 68
Figure 46: Brazil Automotive Parts Exports (Percentage of automotive parts sales) ................ 68
Figure 47: Brazilian Real vs. US dollar Average Annual Exchange Rate ....................................... 69
Figure 48: Brazil Passenger Car Production by Carmaker (2012) ............................................. 70
Figure 49: Brazil Breakdown of Automotive Parts Sales (2012) ............................................... 74
Figure 50: Brazil Automotive Parts Sales by Segment ................................................................. 75
Figure 51: Brazil Automotive Parts Export Destinations (2012) ................................................. 76
Figure 52: Brazil Automotive Parts Export & Import (USDm) ..................................................... 79
Figure 53: Brazil Vehicle Production by State (2010) ................................................................. 80
Figure 54: Brazil automotive clusters .......................................................................................... 80
Figure 55: Brazil Passenger Car & Light Vehicle Production Forecast (units) ....................... 83

Tables

Table 1: Mercosur Member Countries (as of March 2014): ......................................................... 8
Table 2: Market Indicators of Mercosur Countries ...................................................................... 9
Table 3: Cost indicators for starting a business in Mercosur region (2013) ................................. 12
Table 4: Mercosur Vehicle Production Data .............................................................................. 12
Table 5: Vehicle Ownership Comparison .................................................................................. 13
Table 6: Mercosur Vehicle Sales Data ...................................................................................... 14
Table 7: Top Three Carmakers for each Mercosur Nation by Vehicle Sales ............................ 14
Table 8: Carmakers in Mercosur region & Recent Announcements: ......................................... 15
Table 9: Vehicle Imports as a Percentage of Total Vehicle Sales ............................................... 17
Table 10: Overview of Mercosur Vehicle Safety Regulations & Statistics ................................ 19
Table 11: Vehicle Purchases in Argentina by Financing Source .............................................................................. 27
Table 12: Mercosur Comparative Wages ................................................................................................................... 31
Table 13: Top 10 Bestselling Car Models in Argentina (2013) ................................................................................ 32
Table 14: Carmakers in Argentina ........................................................................................................................... 37
Table 15: Planned New Car Models in Argentina .................................................................................................. 39
Table 16: Automotive clusters in Argentina ........................................................................................................... 43
Table 17: Argentina Who-Supplies-Whom data .................................................................................................... 45
Table 18: Import Tax rates .......................................................................................................................................... 51
Table 19: IPI Tax Chart ............................................................................................................................................... 53
Table 20: Summary of Inovar-Auto Programme ...................................................................................................... 54
Table 21: Vehicle Price Comparison US vs. Brazil .................................................................................................. 55
Table 22: IPI Tax Chart for Passenger Cars ........................................................................................................... 55
Table 23: Brazil’s Proconve Emissions Programme for Light Vehicles ..................................................................... 57
Table 24: Sales and Market Share of Carmakers in Brazil (2012) ........................................................................... 62
Table 25: Top Ten Vehicle Sales by Model in Brazil (2012) .................................................................................... 63
Table 26: OEMs and Assembler’s Plants in Brazil .................................................................................................. 69
Table 27: Planned New Car Models in Brazil ........................................................................................................... 73
Table 28: Top 25 Automotive Suppliers in Brazil Ranked by Sales (2012) ................................................................. 74
Table 29: Brazil Who Supplies Whom data .......................................................................................................... 82
crisis in 2001 erupted in violent public protests, which subsequently led to capital flight and the resignation of then President Fernando de la Rúa – inflation levels in the late 1990s reached a peak of 20,000% and Argentina defaulted on its sovereign debt. Rúa's successor, President Néstor Kirchner brought stability and growth to the economy and restructured Argentina's debt burden.

Today, Argentina is a presidential republic, with a president elected every five years. President Cristina Fernández de Kirchner was elected in December 2007 and is not only the first female President, but also the widow of former President Néstor Kirchner. Her leadership was highly anticipated, yet she has been unable to maintain the momentum both on the political and economic fronts that her late husband's regime was able to. Instead, her government has been plagued with labour strikes, rising inflation and depleting foreign currency reserves.

The crowning move by the Argentinian government recently has been the nationalisation of the oil firm YPF in 2012. The nationalisation was a populist move, but sent shock waves through the international oil and gas industry, as well as foreign companies in Argentina. YPF was 52.7% owned by Spain's Repsol and the Argentinian government accused Repsol of plundering the company, after the country became a net importer of energy in 2011. However, one year after the nationalisation, the Argentinian oil and gas industry remains in shambles. In fact, energy imports are estimated to have significantly increased in 2013 from USD9.2 billion in 2012. The Argentinian government has been in a two year negotiation with Repsol regarding compensation and in February 2014 agreed to pay USD5 billion using bonds, but the deal still needs to be approved by Repsol's shareholders. In the meantime, the Argentinian government has gone ahead and signed a new exploration deal with America's Chevron – a contentious and controversial move, after having just nationalised Repsol. In summary, the energy imbalance in Argentina still remains unresolved and currently there doesn't seem to be a solution in sight.

The Kirchner administration has also been using import restrictions and import substitution schemes as a means to boost domestic manufacturing and exports – the increase in demand for imported goods, especially imported vehicles, has surged and is worrying the government. Sales of imported vehicles as a percentage of total vehicle sales were 63.2% in 2011, up from 39.3% in 2000. These import restriction measures have been important in increasing US-dollar inflows into Argentina, so that the government can re-pay its high foreign debt. Part of this strategy has been to stop issuing automatic import licences, which includes import licences for vehicles and automotive parts. These moves have led to complaints from Mercosur member countries and retaliatory tariffs by countries like Mexico. In the automotive industry, the government has struck import substitution deals with international carmakers. For example, Hyundai signed a deal to export peanuts, wine and soy flour from Argentina, in return, to be able to import CBU (completely built-up) vehicles into Argentina. The government has signed similar ‘dollar-for-dollar’ import-export balancing deals with other carmakers, such as BMW, Chery, Fiat, GM and VW. In January 2013, the government also increased import tariffs to 35%, the highest allowed under the WTO. This increase is to be effective until December 2014. These policies are not only making Kirchner unpopular domestically, but are also worrying international investors.

Argentina's GDP can be broken down into the following sectors: service 56.2%, industry 32.8% and agriculture 11%. Argentina is one of the world’s major agricultural producers, ranking among the top producers in many products, such as beef, cereals, soybean, corn and fruit. However, while agriculture accounts for 11% of GDP, the service sector is the largest contributor to GDP. Service sector businesses such as the telecom sector have recently attracted large international investments. Another sector that is attracting international investments and increasing exports is the mining sector. Argentina is rich in natural resources and is a major producer of copper, gold and aluminium. The automotive industry in Argentina generates 5.6% of the industrial GDP.

One of the main hurdles of the Argentinian government is controlling its domestic economy. Plagued by inflation, controlling the peso has historically been a critical issue. Between 1975 and 1990 the Argentinian economy suffered from hyper-inflation, with inflation levels reaching an average of 200% and peaking at 20,000%. To control this situation, the Argentinian government decided to peg the currency to the US-dollar on a one-to-one basis in 1991. The peg was dissolved in 2002, which led to Argentina defaulting on its sovereign debt. The peso has since continued to depreciate against the US-dollar and this is continuing to worry investors and putting pressure on the government vis-à-vis its international debt obligations – in 2012, the peso was allowed to depreciate by 12%, but during 2013, the peso at one point had dropped by 33%. This uncertainty means that there continues to be a run on US-dollars domestically, with a widening gap between the official and black market rates evolving. This is a situation the government is having a difficult time controlling, as its own
US-dollar reserves dwindle. However, on the flipside, the depreciation of the peso does make Argentinian exports more competitive on the international market.

![Figure 11: Argentinian Peso vs. US dollar Average Annual Exchange Rate](image)

Inflation continues to be a major issue facing the Argentinian government. Reliable inflation figures, however, are almost impossible to obtain, with the Argentinian governmental only releasing inflation numbers that are obviously low. Current inflation rate estimates range from 10% to 55%, with the real rate probably somewhere in between. Keeping inflation in check at a manageable level is going to be important to keep consumers happy, stop capital flight and help economic growth.

Stimulating capital inflows into Argentina should be a priority for the government, yet the unstable economic situation and numerous anti-international policies are scaring away investors. The Economic Commission for Latin America and Caribbean (ECLAC) estimates that foreign direct investment (FDI) into Argentina in 2012 amounted to USD12 billion, substantially less than Brazil's USD65 billion and Chile's USD30 billion. The bottom line is that the uncertain economic situation and the Argentinian government’s track record of not adhering to rules are making it difficult for international companies to make long-term commitments in the country.

Under the current circumstances, President Cristina Fernández de Kirchner is facing increasing pressure, both domestically and internationally. For now, general elections are planned to be held in 2015. And as things stand right now, Kirchner cannot stand for a third term, unless she challenges the two-term limit. Many investors and neighbouring countries are hoping that a new government, with new strategies post-2015, will roll back some of the economic policies implemented by the Kirchner government.

### Planned investment in infrastructure development projects

Argentina is well-placed geographically, bordering Chile, Bolivia, Paraguay, Brazil and Uruguay. Brazil is Argentina’s biggest trading partner, both in terms of imports and exports. Compared to other countries in South America, Argentina actually has a good infrastructure system. However, with the boom-bust economic cycles Argentina has experienced, the existing infrastructure network is in dire need of new investment. The country in the past has received funds from the World Bank and other development agencies and governments to invest in its infrastructure, but this has not been sufficient to keep the infrastructure network up-to-date. The Argentinian government historically has spent less than 3% of GDP on infrastructure.

Argentina’s infrastructure network consists of: