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AirFrame Transport optimized 360U ORv2 Rack variant.

Samuli Toivola

Lead HW Architect

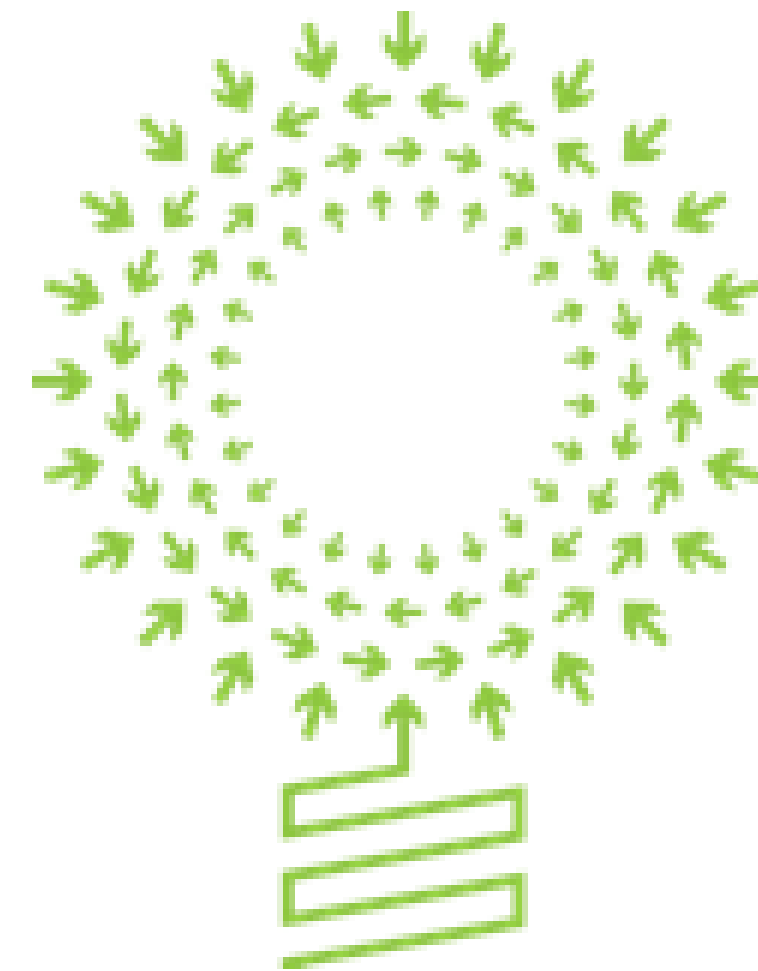
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AirFrame Transport optimized 36OU ORv2 Rack variant

Transport optimized Open rack for supporting global deliveries and deployments at existing central office sites.

By optimizing the height Open Rack usability is enhanced to support wider variety of installation sites thus creating bigger addressable market for industry leading compute and storage solution. Rack design implements Seismic Zone 4 support starting from a single rack deployment.

Experiences from 4200 ORv2 deployments

Typical Installations

- Number of racks in one installation is typically less than 10 per site.
- No greenfield installation, installations are done to existing brownfield sites.
 - Requirement to adapt to existing environment.
- Everything is redundant in order to guarantee high availability for the service.
 - Switches, NICs, cabling, HDDs/SSDs, ...
- Telco requirements like NEBS are still mandatory in many cases.
- Installations are customer specific.
 - No common blueprint, customized configurations required.

Transportation

- Rack and stack on site is typically not allowed.
 - Pre-installed racks are preferred.
- Installation sites are all over the world and due to long lead times sea cargo is not possible.
 - Air freight is used for pre-installed racks.
- Current Nokia Open Rack v2 height is 42 OU
 - Height x width x depth: 2258 mm x 600 mm x 1067 mm.
 - Palletted rack crate height is ~2500 mm which creates challenges for air freight.
- Transportation tolerance according to NEBS is required.

Site Physical Limitations

- Fully equipped Open Rack v2 weight is >800 kg \rightarrow >1200 kg/m²
 - Floor load capacity sometimes limits the configurations.
- Rack depth is limited in many locations
 - Old telco central office sites can limit depth to 800 mm
 - Edge sites are typically existing radio sites where rack depth is max 600 mm
- Old sites typically also have limitations due to
 - Elevator capacity
 - Delivery path height (door openings)
- Site surveys have to be done before shipping.
 - Colo Facility Guidelines for OCP racks defined in OCP Data Center Facility project is providing good framework.

Power and Cooling

- Old telco sites typically have -48VDC power feed infrastructure with battery rooms
- Several AC power feed options for global use cases are needed, e.g.
 - 110VAC, 208VAC, 230VAC, 380VAC, single phase, three phase, 50/60 Hz, different wattages, different connectors, ...
- Power cabling from top and bottom both need to be supported.
- Site power budgets quite often limit size of installations
 - Limitation can be as low as 4 kW per rack
- Site cooling capacity quite often limits rack configurations
 - Limitation can be as low as 4 kW per rack
- Integrated BBUs not in use
 - Difficult to manage due to lithium (transportation limitations)

Compliance

Standard telco equipment environmental requirements are still mandatory in most cases.

- **Safety:** IEC 62368-1:2014, EN60950-1: 2006 + A2:2013 and IEC 60950-1 for safety, including national deviations, GR-1089-CORE.
- **EMI/EMC:** EN300386 (v1.6.1), CFR 47, FCC 15, class A, CISPR 22 Class A and CISPR 24, TEC/EMI/TEL-001/01/FEB-09 and TEC/IR/SWN-2MB/07/MAR-10, GR-1089-CORE
- **Temperature tolerance:** ETSI EN300 019-1-3 Class 3.1, ETSI EN300 019-1-3 Class 3.2, GR-63-CORE, section 4.1.
- **Seismic tolerance:** GR-63-CORE, section 4.4 Zone 4
- **Transportation and storage:** ETSI EN 300 019-1-2 v.2.2.1 class 2.2, EN 300 019-1-1 [20] Class 1.2, EN 300 019-1-2 [21] Class 2.3
- **RoHS:** EU RoHS directive 2011/65/EU Article 7b (EN 50581 (2012))
- **WEEE:** EU WEEE (Waste Electrical & Electronic Equipment) Directive 2002/96/EC and recast WEEE Directive 2012/19/EU
- **REACH:** EU REGULATION (EC) No 1907/2006
- **Fire resistance:** ANSI T1.307-2007 and the requirements specified in GR-63-CORE chapter 4.2.3, GR-63-CORE chapter 4.2.2.2 Shelf-Level Fire-Resistance Criteria.
- **Energy efficiency:** ATIS-0600015
- **Acoustic noise:** GR-63-CORE, section 4.6

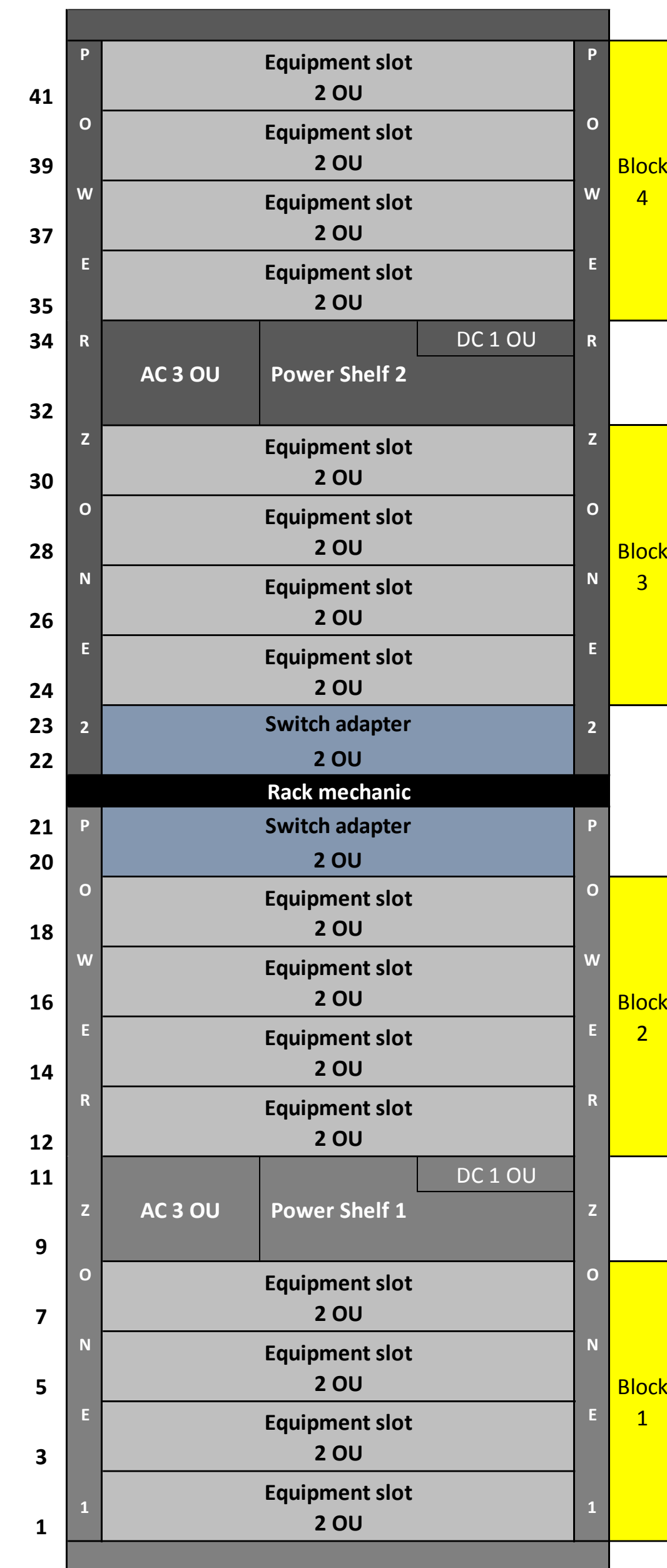
Typical Rack Level configurations

Current Nokia AirFrame Open Rack v2

- Two independent power zones
 - One 12 VDC busbar per power zone
- Power shelf options
 - 208/415V AC
 - ETSI Negative 48V DC
- 4 OU for switches by default
- 32 OU for IT devices
 - Divided in 4 identical blocks

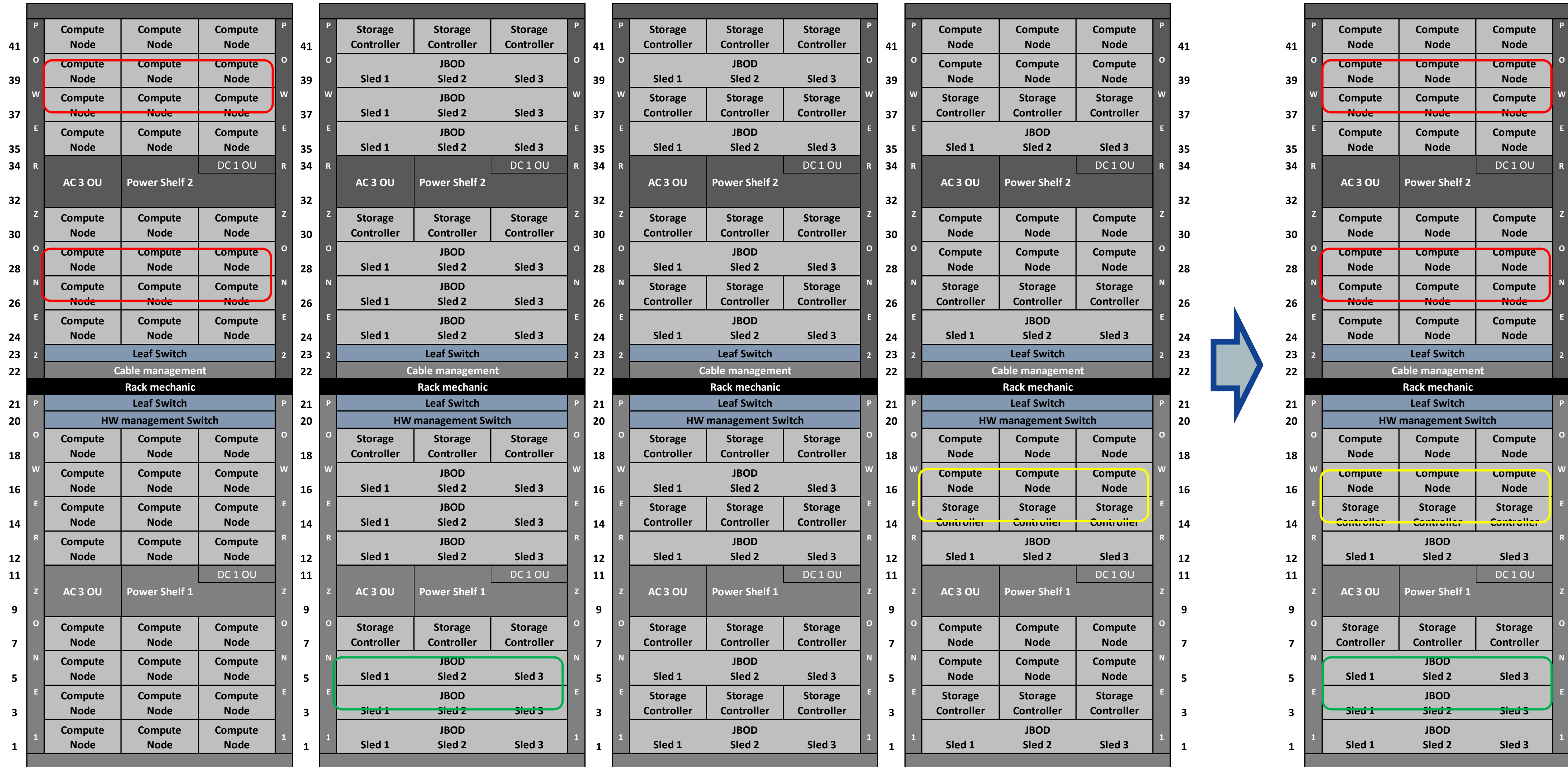
Four different block types defined

- Compute block
- 3x JBOD block
- Dual 1x JBOD block
- Compute + 1x JBOD block



Templates simplify creation of rack configurations

Example rack layout



Typical configurations with 42 OU Rack

- Most typical target configuration for Telco NFV use case is:
 - Three Compute blocks
 - Compute + 1x JBOD block
 - Two Leaf switches
 - One HW management switch
 - Optionally single Spine switch that reduces amount of Compute units
 - → Up to 45 servers and one JBOD (up to 45 disks)
- However previously mentioned limitations in allowed weight, used power or cooling capacity often limits the configuration
 - Unnecessary cost in transportation
 - Unnecessary material in rack frame, air blockers, busbar's etc.
 - Average server amount in configurations is 36

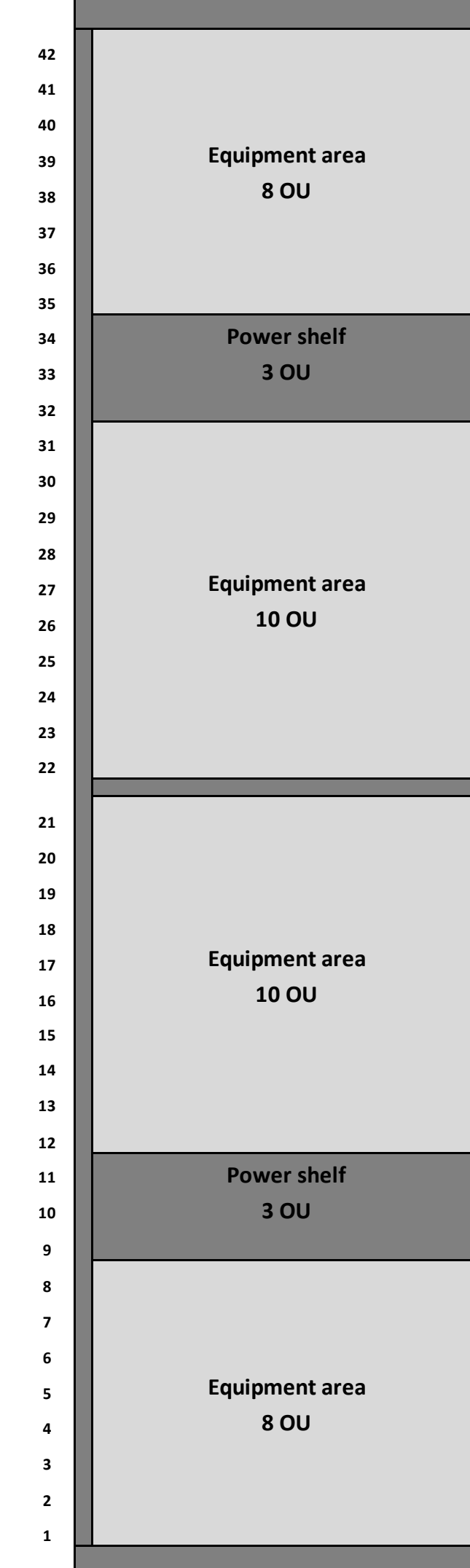
New 36 OU ORv2 rack proposal

36 OU Open Rack proposal

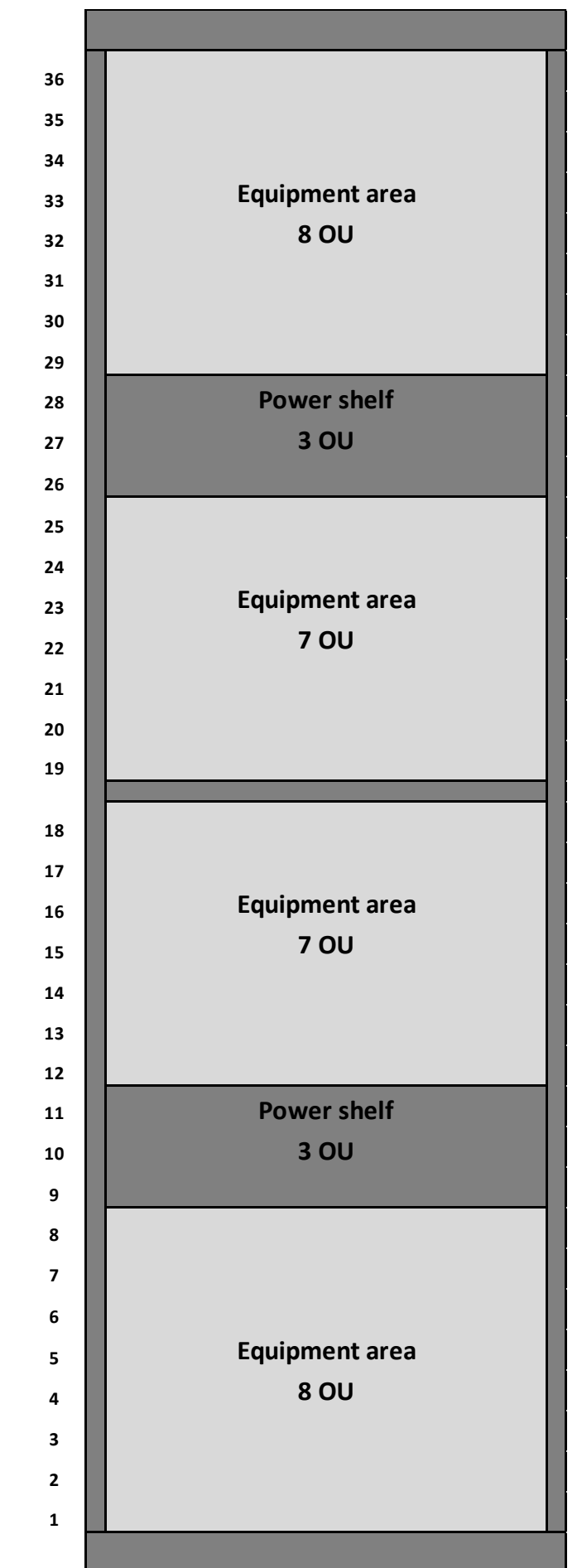
- Modification from current 42 OU to 36 OU rack frame
- Compliant with Open Rack v.2.0 standard
- Seismic zone 4 compliancy with 800 kg IT load
- 36 OU installation space for equipment
- Optional side panel and door sets
- Dimensions: 1970 mm x 600 mm x 1067 mm
- Weight: ~140 kg

- Better compatibility with limited space/power/cooled Telco sites
 - Less height, weight and power consumption
- Easier handling compared to current 42 OU rack
 - Transportation with standard cargo planes
 - Easier handling on limited sites (ramps, lifts, corridors, stairs)

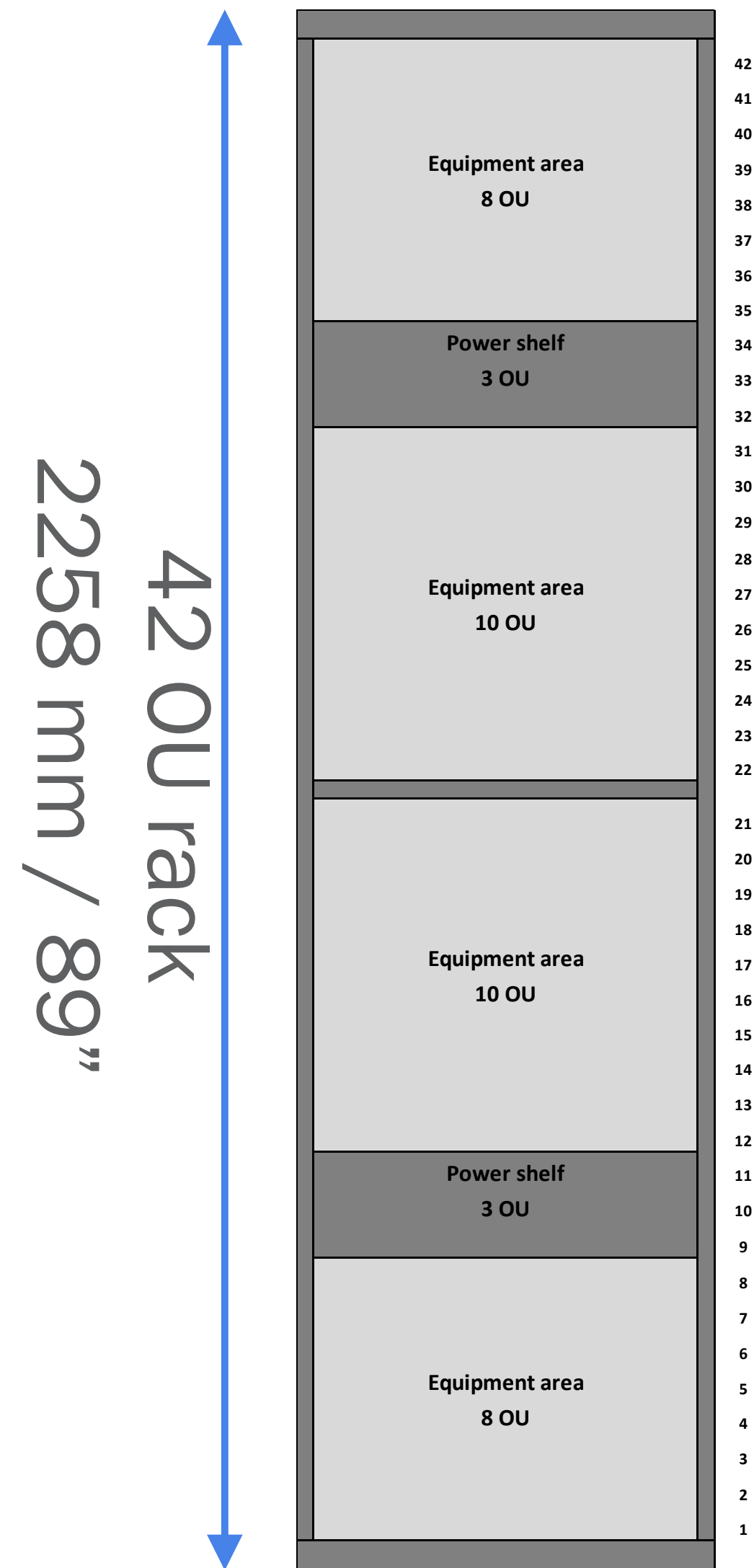
Current 42 OU rack



New 36 OU rack

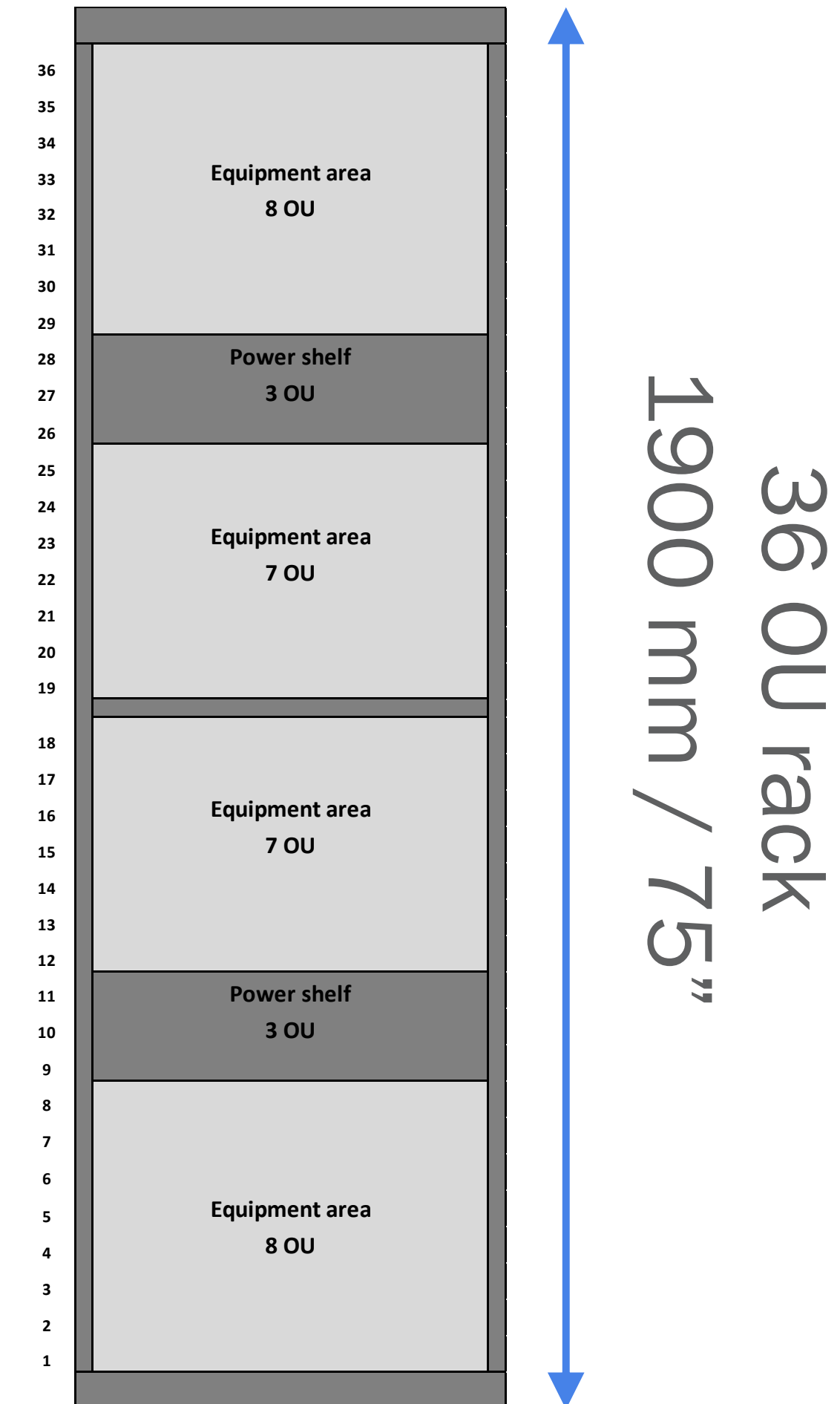


Open rack comparison 42 OU / 36 OU



Example rack configurations with full server configuration

	42 OU	36 OU
Server qty	48	39
Weight	812 kg 1790 lbs	690 kg 1520 lbs
Power (typical)	12 kW	10 kW



Planned Telco NFV optimized configuration with 36 OU rack

- Most typical target configuration for Telco NFV use case is:
 - Two Compute blocks
 - Compute + 1x JBOD block
 - Two Leaf switches
 - One HW management switch
 - Optionally single Spine switch
 - → Up to 36 servers and one JBOD or 39 servers

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Summary

Summary

Why alternative rack height is needed

- Transportation of 42OU Open Rack requires special arrangements in airfreight
- Some of the Central Office installation sites has height limitations
 - Height of doors
 - Height of elevators
 - Height of CO equipment rooms
- Rack weight and power consumption is sometimes an issue
 - In these cases optimal weight and power consumption can be achieved with the smaller rack

PLAN for Nokia Open Rack variant is to contribute the spec and apply for OCP Inspired recognition. Target timeline for spec contribution is 2nd quarter 2019 and target to have product available on OCP marketplace in 2019

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