

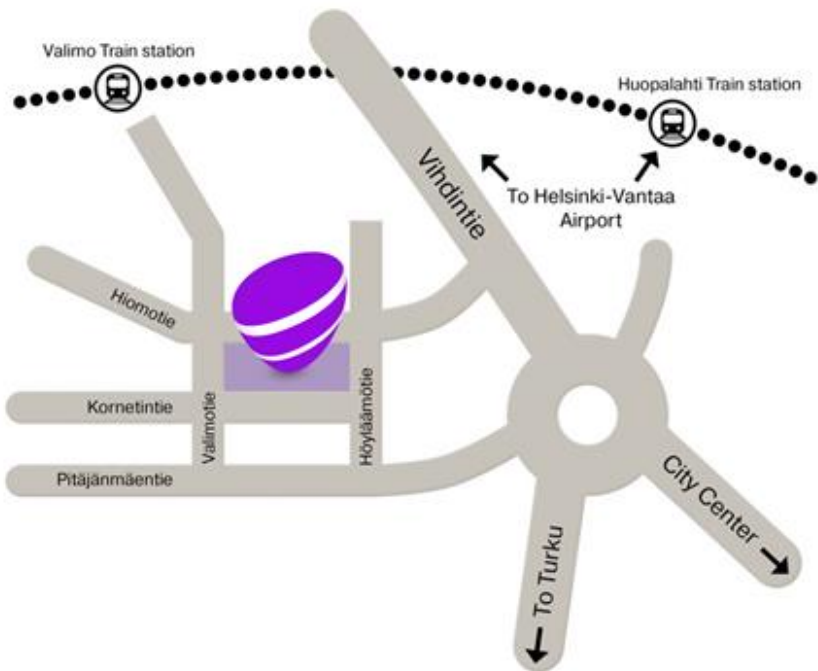


COMMENT PITCH: PRACTICAL CHALLENGES IN ENERGY EFFICIENT DATACENTER IMPLEMENTATION – CASE TELIA HDC

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4.3.2020



TELIA HELSINKI DATA CENTER IN A NUTSHELL



Building area in four floors

34 342 m²

White space

15 000 m²

Critical IT-power

24 MW

Recycled heat

~258 000

MWh/year

Space for racks

5 000

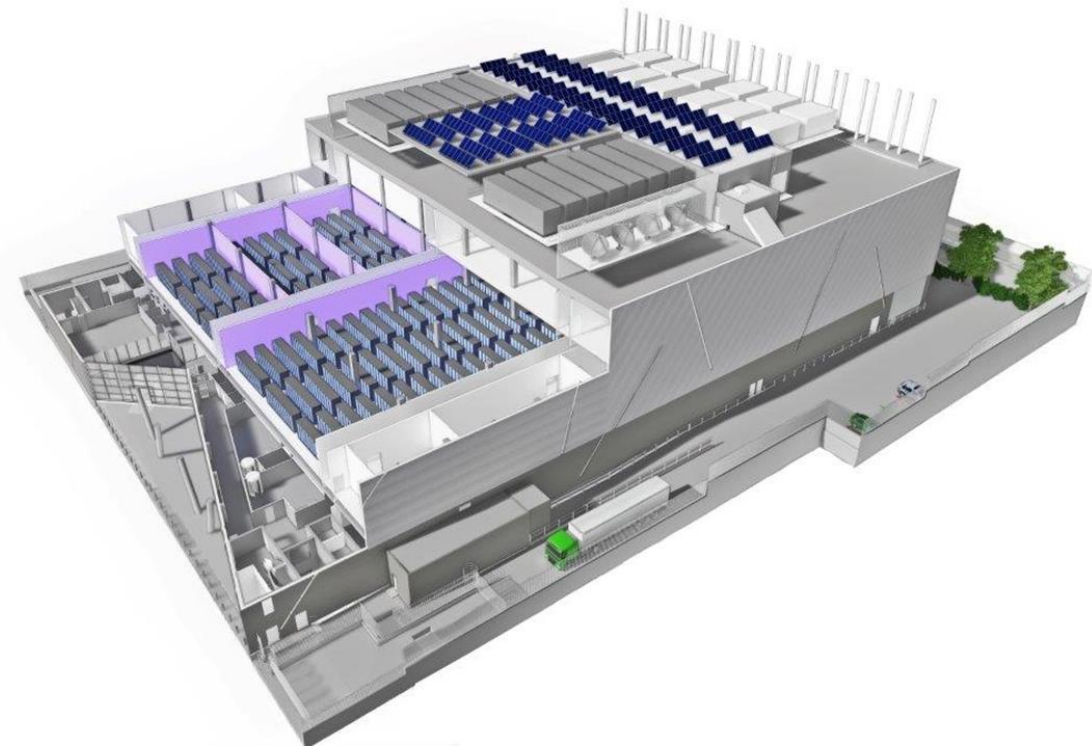
Up to devices

200 000

Tier III level reliability

WORKLOAD CONSOLIDATION – INDUSTRIAL SCALE IMPROVES EFFICIENCY

- Telia Helsinki Data Center target PUE is 1.2 for mixed co-location customer workload
- This efficiency level is extremely hard to reach in small customer datacenters – scale, ground-up design and diligent operations are pre-requisites for such efficiency
- We typically see PUE in the scale of 1.6-2.0 in legacy data center environments which means 3-5 times more “waste” in electricity consumption
- Customer workload migrations are costly projects and investments are of fully depreciated. The target environment must be able to deliver tangible financial benefits (read: lower prices) to provide justification for such spend
- **Comment: datacenter segment net efficiency would increase dramatically if workloads would be more consolidated to purpose-built facilities with industrial scale**



HEAT REUSE – COSTLY INVESTMENTS AND CHALLENGES IN FINDING FEASIBLE COMMERCIAL TERMS

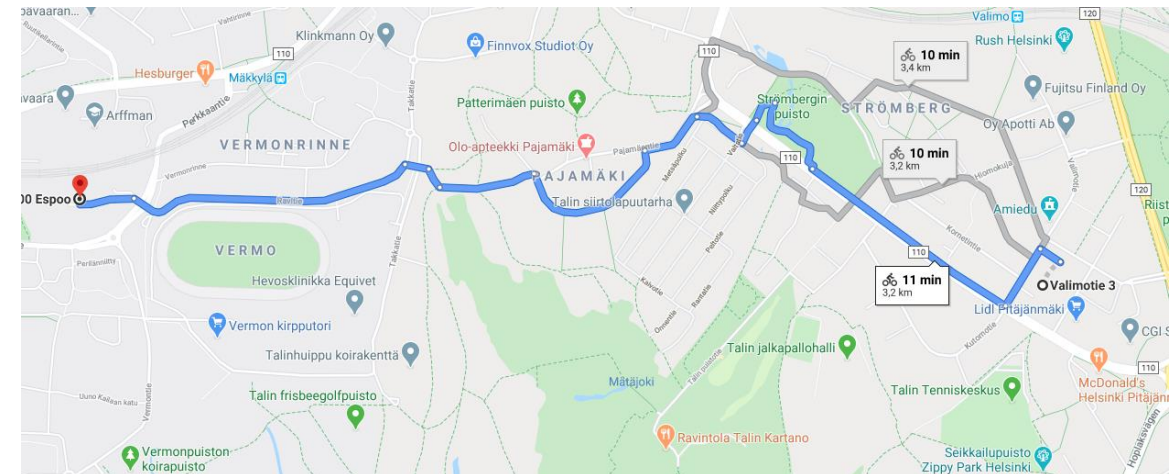
- Telia Helsinki Data Center is located in an area with district heating network for office buildings, housing and apartment blocks to enable effective reuse of waste heat produced in the datacenter
- Heat reuse requires heat pumps with estimated investment value of ca. 700k€ to move heat from ca. 30° cooling water to >80° district heating water
- Helsinki Energia is the district heating provider in the area – Telia has been unable to find commercial terms that would justify investments, Helen would like to sell district cooling instead of buying waste heat
- A LOI has been signed with Fortum with more favourable commercial terms. However, Fortum network is ca. 2 km away from Telia facility and pipeline construction increases dramatically the needed investments and required heat volumes in order to be lucrative
- **Comment: heat reuse is technically sound idea, but justifying the investment and entering into an agreement can be complicated as district heating providers do not have to take in these external heat sources.**

FORTUM OYJ LEHDISTÖTIEDOTE 24.10.2016

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Fortum ja Sonera ovat solmineet aiesopimuksen Soneran uuden datakeskuksen hukkalämmön hyödyntämisestä kaukolämpönä.

Sonera rakentaa Helsingin Pitäjänmäelle Suomen suurinta avointa datakeskusta, jonka on määrä valmistua vuoden 2017 lopulla. Datakeskuksen konesalin tietokoneet synnyttävät tulevaisuudessa merkittävän määrän hukkalämpöä. Nyt solmitun aiesopimuksen myötä se kerätään talteen ja johdetaan lämmittämään espoolaisia koteja ja lämmintä käyttövetä. Lämmön kerääminen alkaa siinä vaiheessa, kun hukkalämpöä syntyy riittävästi. Tämä tapahtuu todennäköisesti vuoden 2019 alussa.



FINNISH ENERGY TAXATION – ECONOMICS OF TRULY MASSIVE SCALE ONLY

- Datacenters that have more than 5MW of live load are getting taxed according to tax class 2 which means 1.55 c/kWh lower tax rate for consumed electricity
- Lower taxation applies to individual consumption locations only and can not be applied to multi-location datacenter or teleoperator infrastructure – Telia's >200GWh annual consumption in Finland is not seen as energy intensive industry
- 5MW is a massive load threshold compared our Swedish counterparts (0.1MW) and reaching that level with commercial co-location service is a lengthy exercise and requires years of sales, migrations and growth
- **Comment: Customers seek financial motivation to consolidate and migrate – tax class threshold is too high to provide enabling production cost decrease. Tax benefit due to heat reuse or lower load threshold would speed up consolidation by offering the further motivation.**

Energiaverotuksen uudistus

Lisätään energiantuotannon päästöohjausta poistamalla teollisuuden energiaveron palautusjärjestelmä ja alentamalla II veroluokan sähkövero kohti EU:n sallimaa minimitasoa. Uudistus toteutetaan kustannusneutraalisti siirtymäkauden kuluessa. Siirretään sähköveron veroluokkaan II kaukolämpöverkkoon lämpöä tuottavat lämpöpumput ja konesalit.

Finland is likely to further strengthen its competitiveness as a location for large data center projects by lowering its energy tax rate in the near future. The tax cut is included in the program of Finland's recently elected government and is part of a broader tax reform package for industry that will be debated by parliament next year. The new energy tax rate for data centers is likely to come into force in 2021.

"Suomen 2. veroluokka koskee vain yli 5 MW:n tai sitä isompia laitoksia. Moni toimija aloittaa toiminnan alle 5 MW:n laituskoollla, joten tässä Suomi antaa veroluokan lisäksi ylimääräistä kilpailuetua Ruotsille. Lisäksi Ruotsi laajentaa 2. veroluokan kaskemaan 0,1 MW:n keskuksia. Tämä mahdollistaa investointien tekemisen yhä pienemmälle asiakaspohjalle. Fingrid on nostanut kantaverkkomaksuja 2016 14% ja 2017 7%, mikä lisää tilanteen haasteellisuutta," toteaa Antti Laine.



TRAFICOM REQUIREMENTS FOR TELEOPERATOR PREMISES (M54) INCREASE OVERHEADS

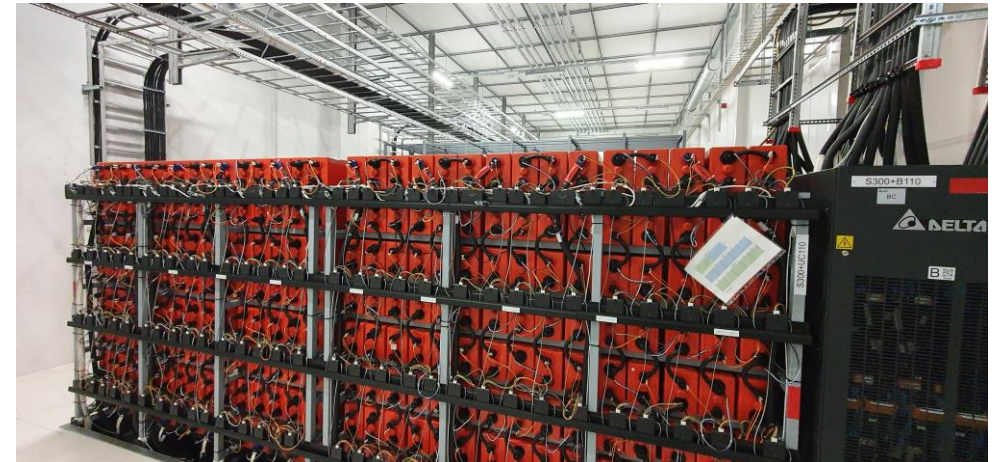
- Telia Helsinki Data Center is used to host Telia's own network assets and it acts as a connectivity hub for Telia's mobile and fixed networks in addition to its role as commercial, open co-location datacenter
- Traficom M54 stipulates how such premises need to be physically protected and how redundancy needs to be implemented
 - Entire basement is a S1 class bomb shelter
 - Site has N+1 generator backup for all workloads with monthly testing plan
 - Operator workloads have 3 hour battery backup and separate cooling systems for such a massive battery "farm"
 - Operator workloads have emergency cooling system in addition to redundant cooling solutions
 - Site has fuel supply tanks and delivery arrangements for rather lengthy runtime
- **Comment: Requirements set forth in M54 are excessive from a hybrid facility's perspective. Bomb shelter structures, N+1 generators and 3 hour battery run time requirements cause material inefficiencies in terms of building cost, battery room space allocations, continuous battery renewal, triplicate cooling systems etc.**

Määräys viestintäverkkojen ja -palvelujen varmistamisesta sekä viestintäverkkojen synkronoinnista

Annettu Helsingissä 17 päivänä joulukuuta 2014

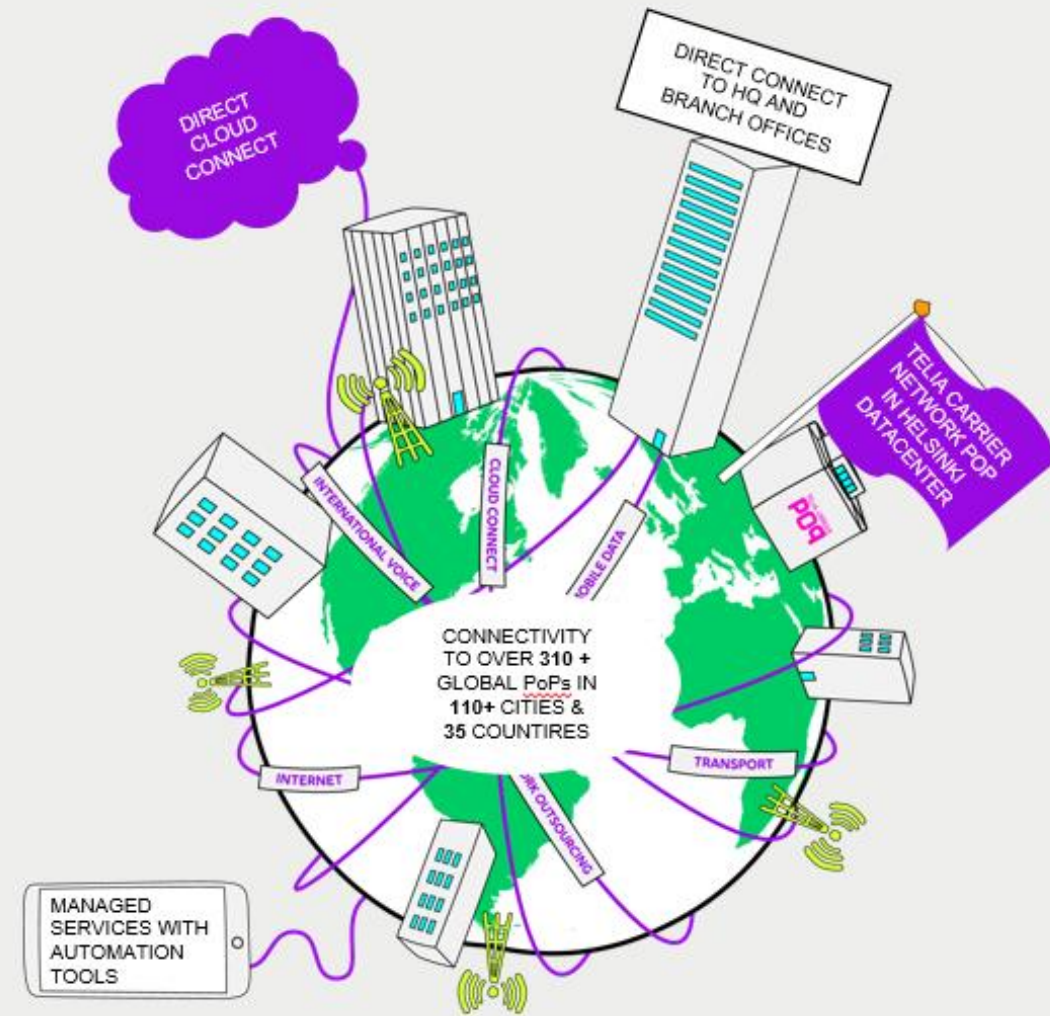
Viestintävirasto on määrännyt 7 päivänä marraskuuta 2014 annetun tietoyhteiskuntakaaren (917/2014) 244 §:n nojalla:

Luku 1 Yleiset säännökset



HDC PROVIDES AVAILABILITY, RELIABILITY AND SECURITY FOR YOUR SERVICES

- HDC is the only data center in Finland that has business continuity and quality management certifications
- HDC provides top level of security and 24/7 on-site guarding
- One-stop shopping for Colocation and connectivity services
- 24/7/365 customer service and customer access to HDC
- Self-service with automation
- Additional monitoring, control and security services to keep your services up and running



APPLICABLE CERTIFICATIONS AND STANDARDS:

ISO 14001:2015 Environmental Management System

Energy Efficiency System + : 2014 (EES+)

OHSAS 18001 Occupational Health and Safety Assessment

ISO 9001 Quality Management (for B2B services)

ISO 22301 Business Continuity Management

ISO 27001 Information Security Management

PCI DSS (Payment Card Industry Data Security Standard)

SOC 2 (Service Organization Control report type II in 2019)



- ✓ Energy efficient
- ✓ Heat recycling
- ✓ CO₂ free electricity
- ✓ Waste recycling

LEED Datacenter V4.0 certification

Ceeda Design and Operate certification