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Greater Insight. Greater Value.

Networks Optimization with Intelligence

Stanley Kaplunov | Stephen Holt (

September 2017 | Washington DC

Confidential Presentation

accenture

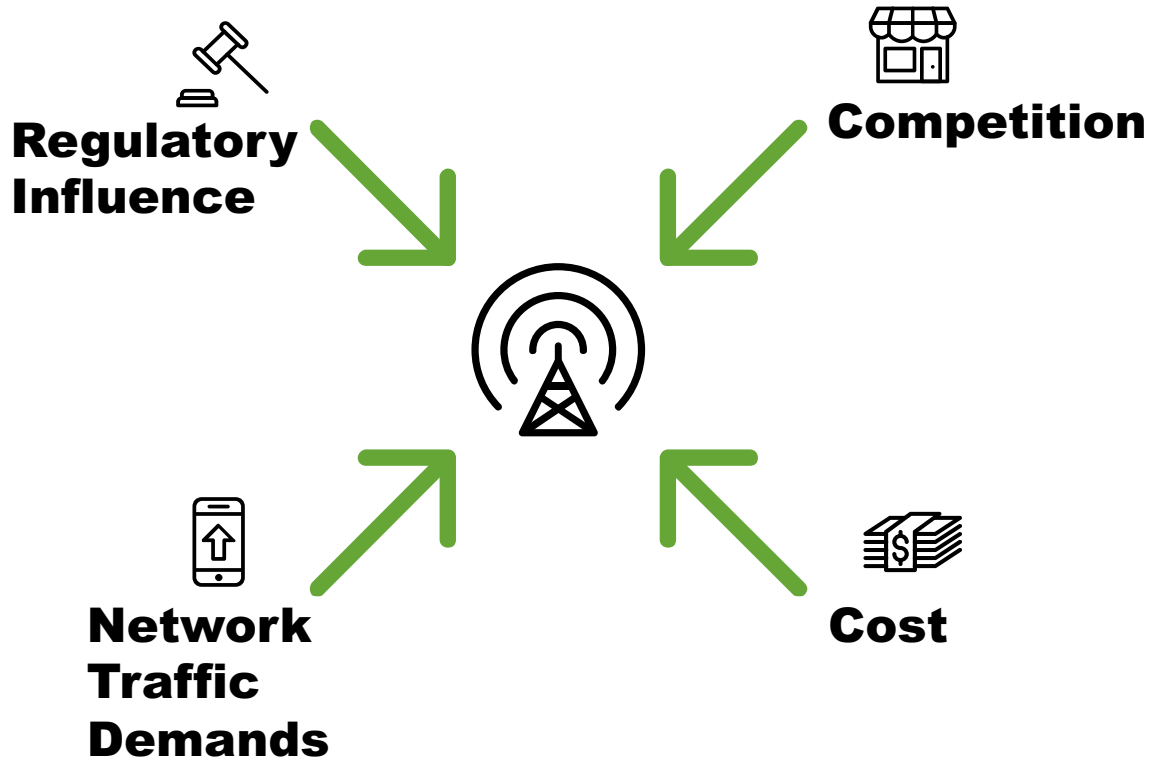
accenture splunk






- ▶ Driving up business value and customer experiences in mobile telecommunications by combining machine learning and real-time analytics.

130.60.4 - - [07/Jan 18:10:57:153] "GET /category.screen?category_id=GIFTS&JSESSIONID=5D15L9FF1ADFF3 HTTP 1.1" 404 720 "http://buttercup-shopping.com/cart.do?action=view&itemId=EST-6&product_id=FI-SW-03"
128.241.220.82 - - [07/Jan 18:10:57:123] "GET /product.screen?product_id=FL-DSH-01&JSESSIONID=5D35L7FF6ADFF9 HTTP 1.1" 404 3322 "http://buttercup-shopping.com/cart.do?action=purchase&itemId=EST-268product_id=KQ-CW-01"
131.27.160.0 - - [07/Jan 18:10:56:156] "GET /oldlink?item_id=EST-26&JSESSIONID=5D55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST-18&product_id=AV-CB-01&JSESSIONID=5D55L9FF1ADFF3 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/cart.do?action=remove&itemId=EST-189"
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► The situation



The solution: Splunk

-  Ability to process millions of data points in real-time
-  Capabilities to apply machine learning algorithms to support data-driven decisions
-  Web framework and sdks (software development kits) to enable customized visualization and data analytics

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itemId=EST-16&product_id=RP-LI-02" "0
to?action=purchasing.com/ol
shopping.com/case&is

The Challenge

► Utilising the power of machine learning, we set out to provide intelligent solutions to some of the industry's key challenges...

OPTIMISE SPEND

Within day-to-day operations where and how can spend be optimised, reducing OPEX and yielding improved ROI on CAPEX of deployed infrastructure. We looked at reducing energy spend and **data centre optimisation** to improve ROI and Spend.



IMPROVE CEX

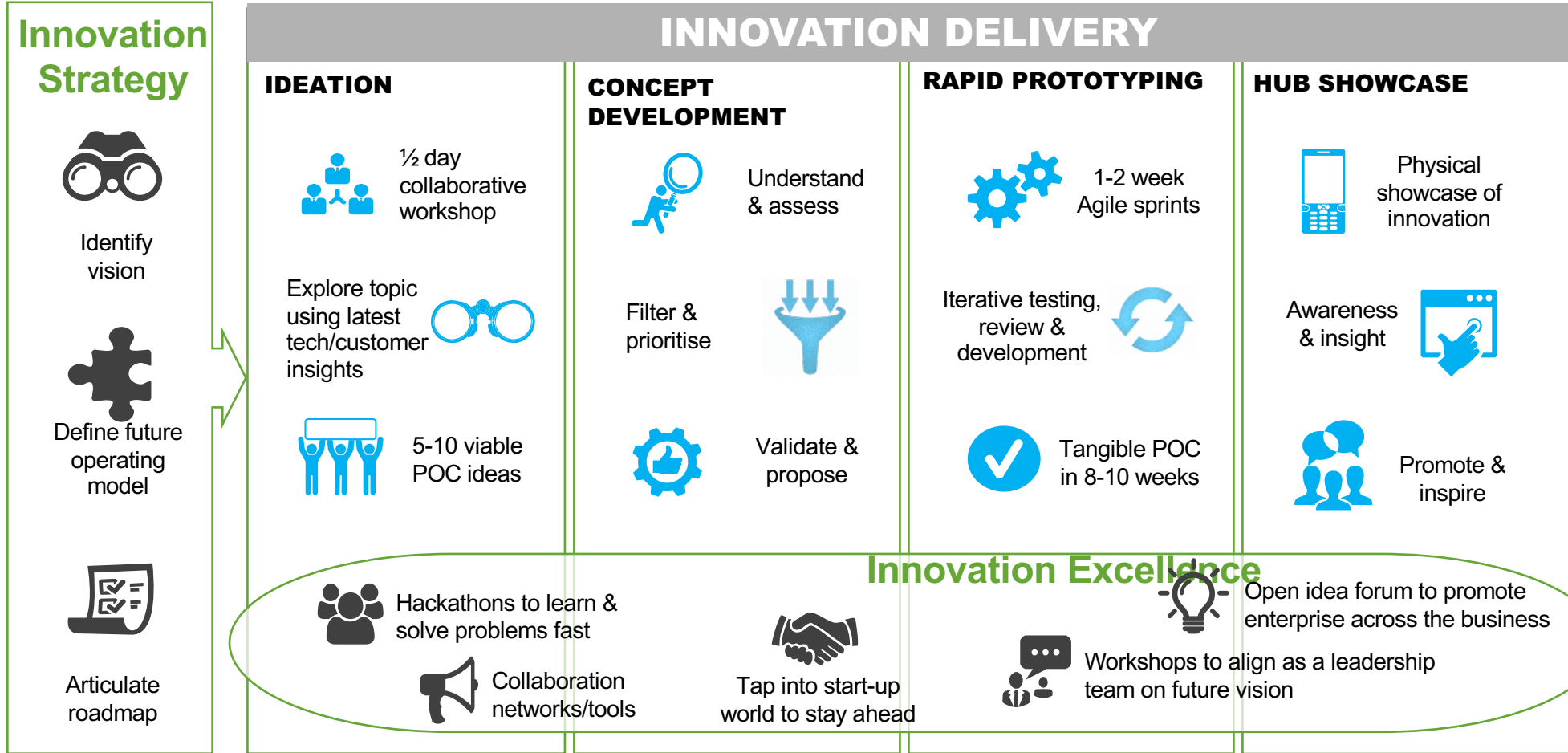
Understanding the impact network performance can have on CEX, we looked at key indicators to assess their performance. These were correlated with CEX indices, and using **traffic forecasting**, we were able to deliver what subscribers want.



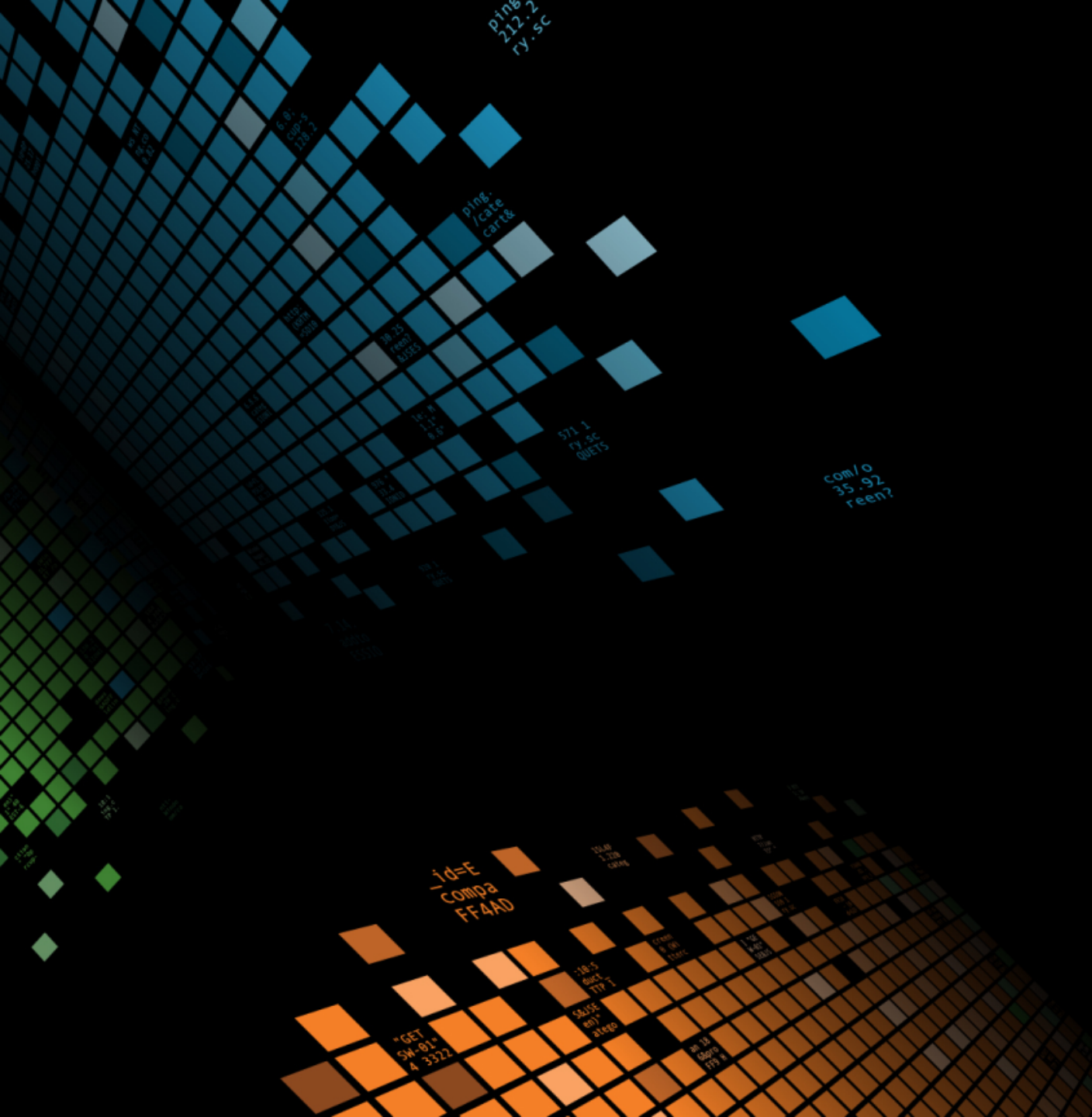
REDUCE CHURN

Performance could be dynamically optimised to ensure that customers receive the best customer experience, raising NPS and reducing churn. Utilising **performance insights**, we were able to target optimisation activities to achieve peak performance.

Innovation Programme Delivery



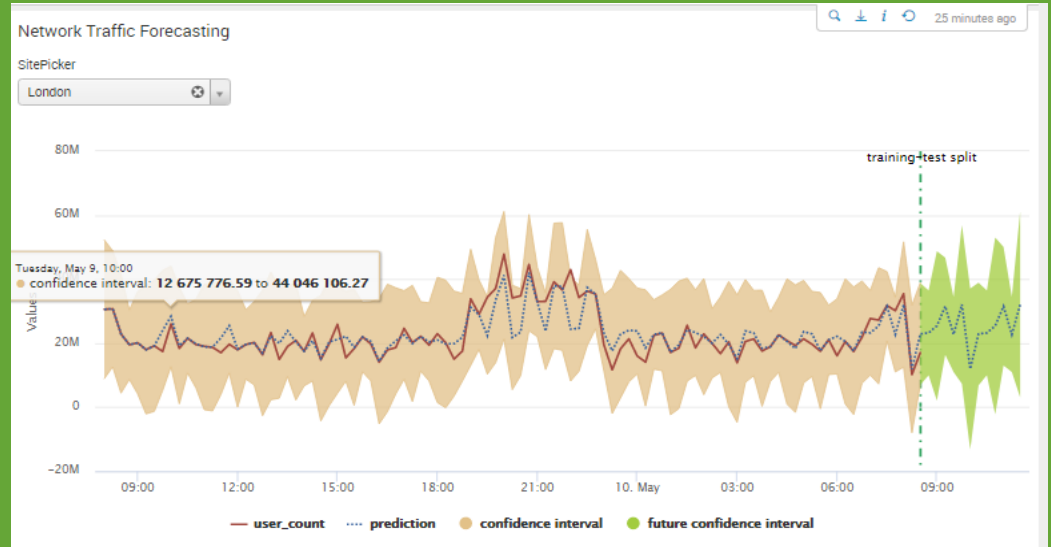
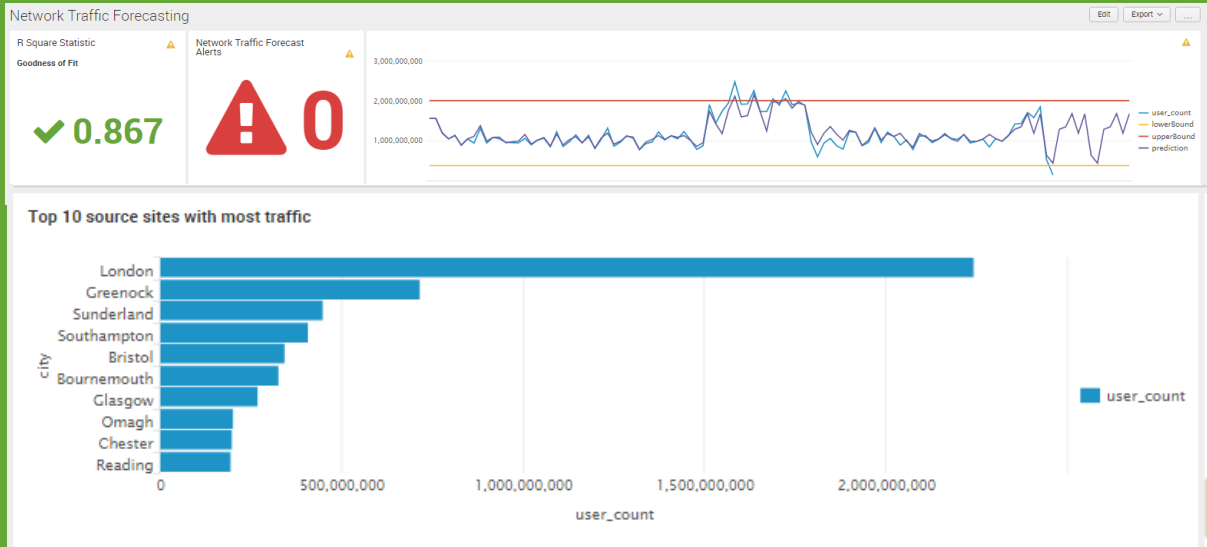
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Network Traffic Forecasting

Network Traffic Forecasting...

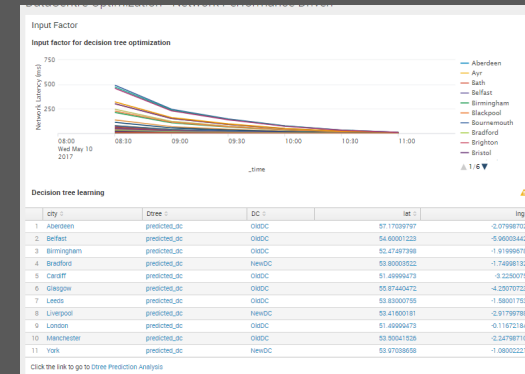
- ▶ ...is powered by linear regression algorithms to gain fast insights into traffic flow, including real-time alerts. Unexpected trends launch alerts and actions, reducing outages and improving the overall customer experience.



Data Centre Optimization

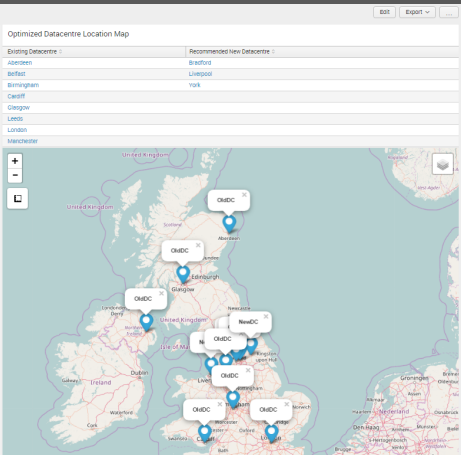
Data Centre Optimization

- ▶ ...panels give a continuous, real-time view into how many data centres are needed to support current and forecasted traffic...

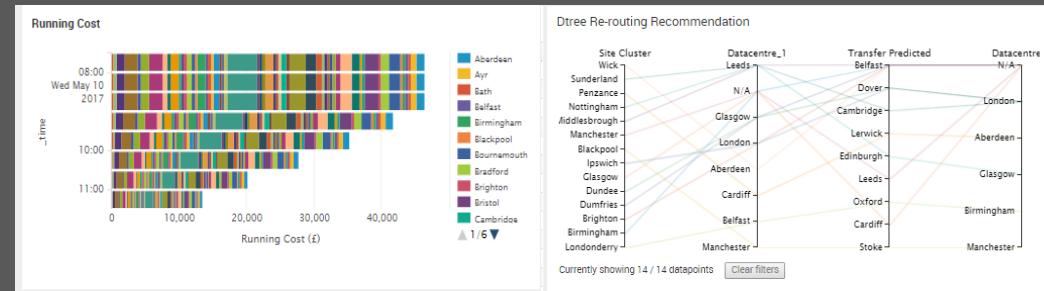


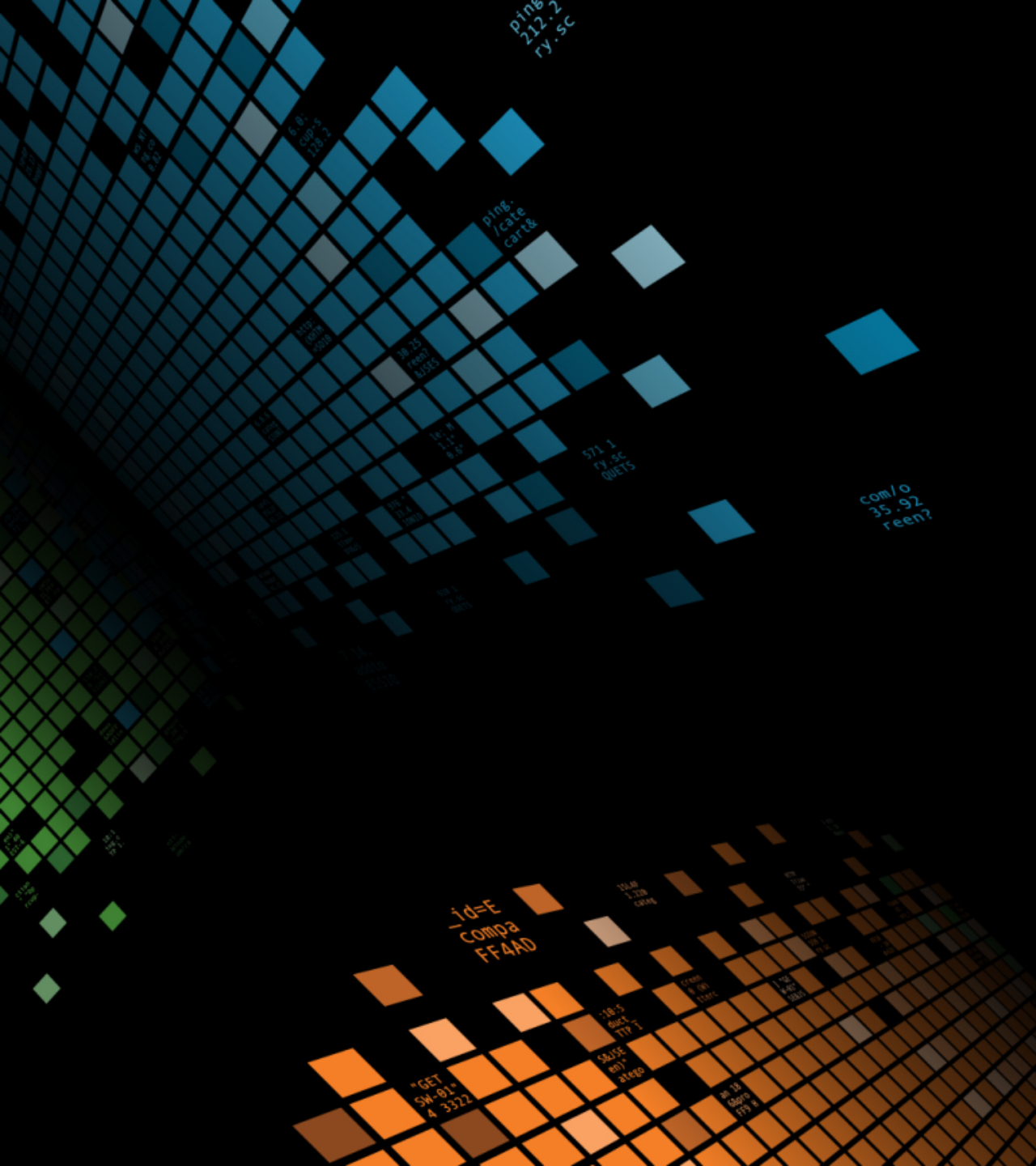
...and where these should be located to provide optimal CEX and performance.

In fact, using our solution, the traditional plan and build of future Data Centres will be disrupted. Moving from classic network infrastructure design (static hardware allocation) to enable the adoption of Software Defined Networks...



...with an expectation to avoid physical builds. Concentrating CAPEX spend where it will provide optimised performance and ROI.



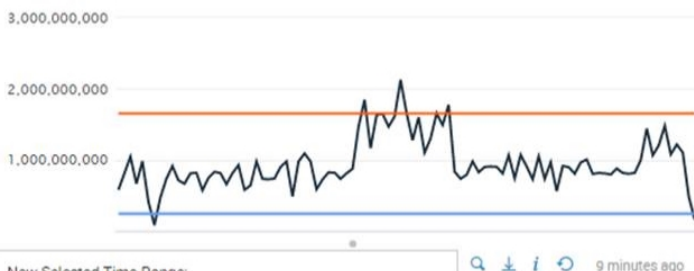


Insights

Insights Into Network Performance Optimization

- ...can be gained by viewing the network route finder, powered by a customised Python pathfinding algorithm, based on Dijkstra's algorithm.

Use Pan and Zoom to Select Time Ranges to check the details of traffic generation sites

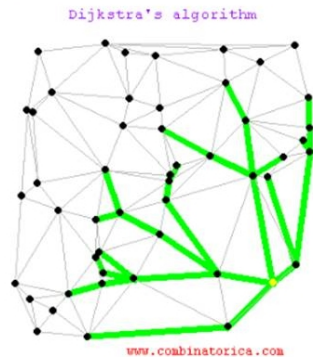


New Selected Time Range:

Time Range: 2017-04-24T09:00:00.000-00:00 - 2017-04-25T09:00:00.000-00:00

Click the link to go to Network Traffic Forecast

Click on Datacentre Details Table link above to show site -> datacentre information.



Top 10 Highest Utilization

city	sparkline	Utilization Rate
Leeds		0.913309
Cardiff		0.908585
Birmingham		0.905566
Belfast		0.905188
Manchester		0.904770
Glasgow		0.877842
Aberdeen		0.769038
London		0.435908

Top 10 Lowest Utilization

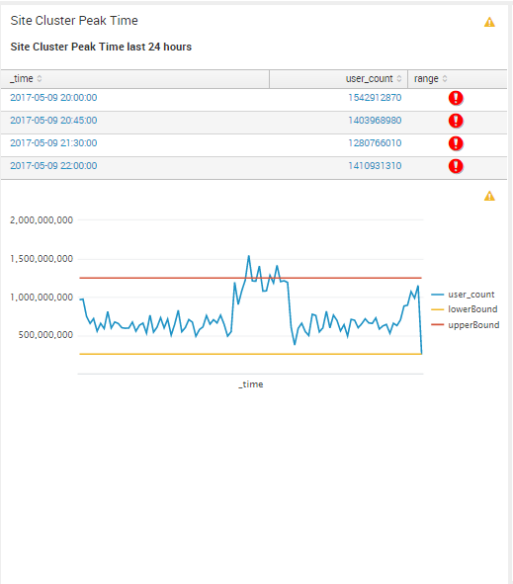
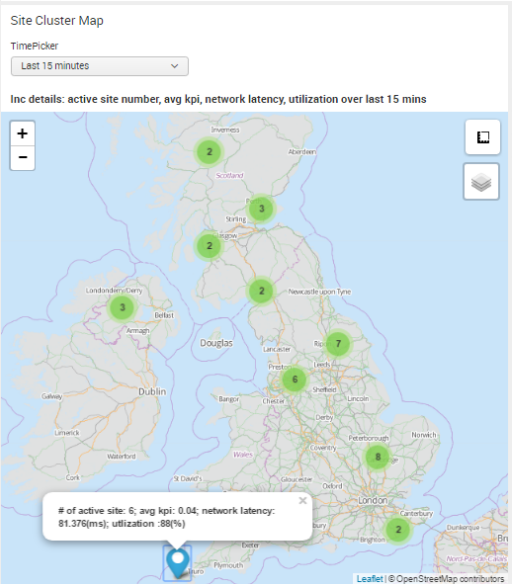
city	sparkline	Utilization Rate
London		0.435823
Aberdeen		0.768793
Glasgow		0.877778

128.241.220.82 - [07/Jan 18:10:57:123] "GET /category.screen?category_id=GIFTS&JSESSIONID=SD5L9FF1ADFF3 HTTP 1.1" 404 3322 "http://shopping.com/cart.do?action=view&itemId=EST-6&product_id=FI-SW-03" Moz/5.1; SVI; .NET CLR 1.1.4322" 468 125.17 14 - [07/Jan 18:10:56:156] "GET /product.screen?product_id=FL-DSH-01&JSESSIONID=SD5L9FF1ADFF3 HTTP 1.1" 200 1318 "http://shopping.com/cart.do?action=changequantity&itemId=EST-18&product_id=AV-CB-01&JSESSIONID=SD5L9FF1ADFF3" Mozilla/5.0 (Windows NT 6.0; rv:1.9.0.1) Gecko/20100801 Firefox/3.5.1 Chrome/20.0.0.0
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“We created
Four network management
personas, each configured
with ML algorithms and
dashboards...”



Click the link to go to Welcome Page
Click the link to go to Network Traffic Forecasting



Site Cluster Manager

Site Cluster Status

TOP 10 Utilization

site cluster	utilization	sparkline
Edinburgh	91.09%	
Oxford	91.08%	
Wick	90.97%	
Dover	90.97%	
Newcastle	90.95%	
Luton	90.79%	
Stoke	90.78%	
Kirkwall	90.76%	
Portsmouth	90.73%	
Peterborough	90.72%	

Top 10 Network Latency

site cluster	network latency	sparkline
Portsmouth	486.95 (ms)	
Bournemouth	484.95 (ms)	
Southampton	446.48 (ms)	
Reading	321.75 (ms)	
Bath	312.30 (ms)	
Bristol	306.41 (ms)	
Londonderry	247.27 (ms)	
Oxford	226.19 (ms)	
Omagh	215.70 (ms)	
Leicester	139.87 (ms)	

Problem Children

Choose a view: Problem Children: KPI, Problem Children: Utilization, Problem Children: Latency

Highest Utilization Rate in Red (>95% site clusters)

Luton
Bradford
Bournemouth
Blackpool
Lisburn
Bristol
Ayr
Bath

Site Cluster Overall Performance

TimePicker: Last 60 minutes

Total Site Clusters: **49**

Site Cluster Overall KPI: **Medium**

Site Cluster Overall Utilization Rate (%): **82.22%**

Site Cluster Overall Network Latency: **95.07 (ms)** ^{4.17}
Compared to 1 hour ago

Selected Cluster Performance

Site Cluster Picker: Greenock

Site Cluster Overall KPI: **Greenock**

Site Cluster Overall KPI: **Medium**

Site Cluster Overall Utilization Rate (%): **69.85%**

Site Cluster Overall Network Latency: **11.46 (ms)** ^{0.11}
Compared to 1 hour ago

```

130.60.4 - - [07/Jun 18:10:57:123] "GET /category.screen?category_id=GIFTS&JSESSIONID=5D55L9FF1ADFF3 HTTP/1.1"
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Data Centre Manager

- ▶ Monitors datacentre status, traffic peak time, and traffic forecasting.



```
130.60.4 - - [07/Jan 18:10:57:153] "GET /category.screen?category_id=GIFTS&JSESSIONID=SD15L9FF10ADFF10 HTTP 1.1" 404 720 "http://buttercup-shopping.com/cart.do?action=view&itemId=EST-6&product_id=FL-SW-01" "Opera/9.80.2013.10291; rv:1.9.1.22 Gecko/Linux x86_64; Chrome/27.0.1453.94"
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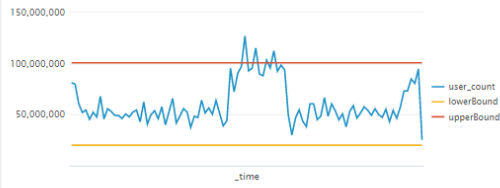
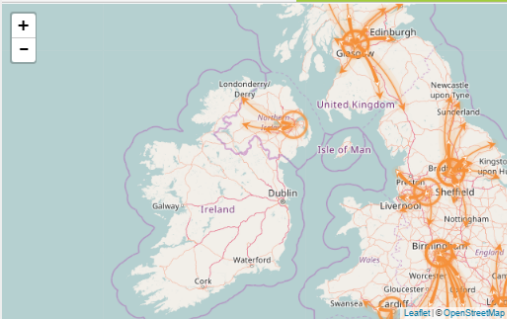
Datacentre Status (last 15m)

Datacentre	Status
1 London	DN
2 Birmingham	DN
3 Manchester	DN
4 Leeds	DN
5 Glasgow	DN
6 Cardiff	DN
7 Belfast	DN
8 Aberdeen	DN

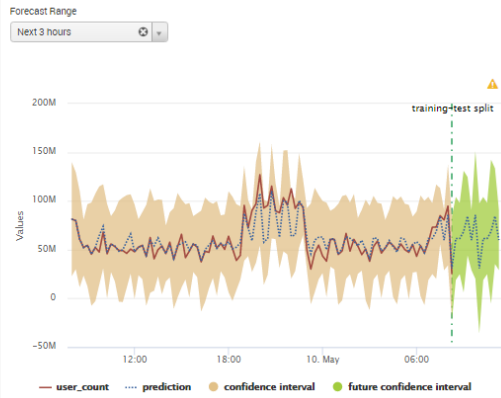
Datacentre Peak Time

Datacentre Peak Time last 24 hours

_time	user_count	range
2017-05-09 20:00:00	126898024	!
2017-05-09 20:45:00	115224912	!
2017-05-09 21:30:00	103363524	!
2017-05-09 22:00:00	112494910	!



Datacentre Traffic Forecasting



TimePicker: Last 24 hours
Datacentre Picker: London

Data Centre Manager

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action=purchase&is.com/ol...
action=purchase&is.com/ol...

Datacentre Status

Utilization

site cluster	utilization	sparkline
Belfast	87.24%	[Sparkline]
Manchester	87.06%	[Sparkline]
Birmingham	87.05%	[Sparkline]
Glasgow	86.91%	[Sparkline]
Leeds	86.75%	[Sparkline]
Cardiff	86.57%	[Sparkline]
Aberdeen	76.33%	[Sparkline]
London	43.54%	[Sparkline]

Datacentre Overall KPI

Medium

Datacentre Overall Utilization Rate (%)

78.43%

Datacentre Overall Network Latency

13.75 (ms) [↑]0.74

Compared to 15 minutes ago

Network Latency

site cluster	network latency	sparkline
Birmingham	30.43 (ms)	[Sparkline]
Belfast	30.21 (ms)	[Sparkline]
London	8.63 (ms)	[Sparkline]
Glasgow	8.63 (ms)	[Sparkline]
Cardiff	8.62 (ms)	[Sparkline]
Leeds	7.31 (ms)	[Sparkline]
Aberdeen	7.31 (ms)	[Sparkline]
Manchester	7.31 (ms)	[Sparkline]

London KPI

Medium

London Utilization Rate (%)

43.56%

London Network Latency

8.64 (ms) [↑]0.01

Compared to 15 minutes ago

C-RAN Manager

- ▶ Combines site cluster performance information with datacentre performance.



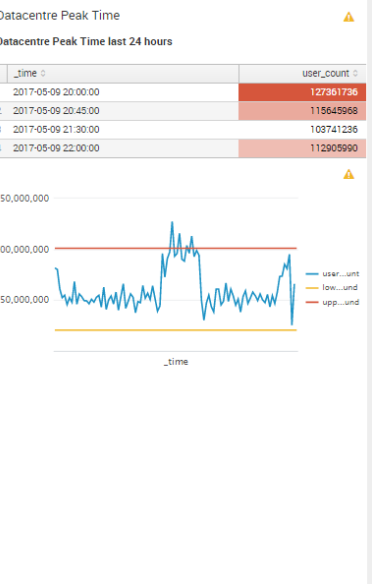
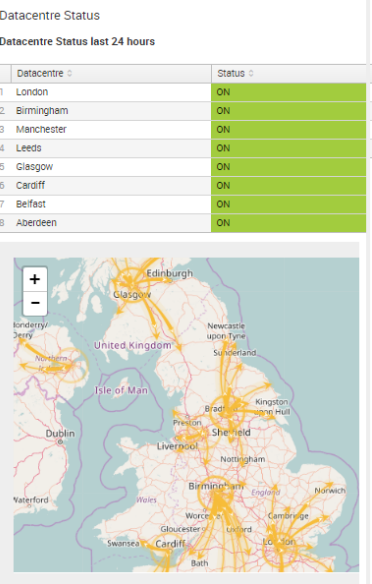
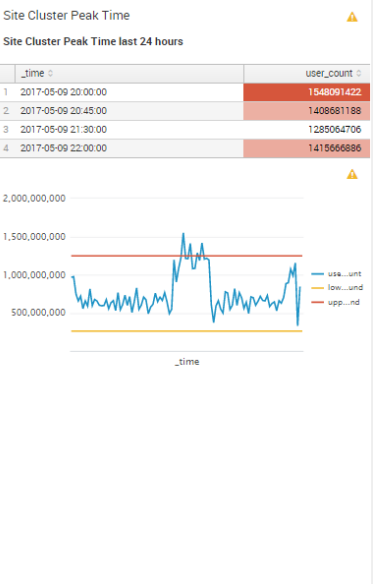
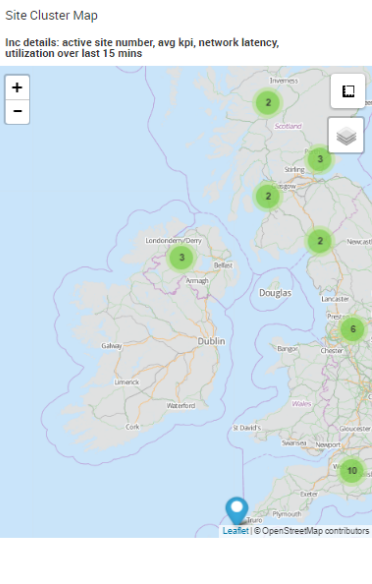
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http://buttercup-shopping.com/category.screen?category_id=FLOWERS&JSESSIONID=SD55L7FF6ADFF9 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/category.screen?category_id=FLOWERS&JSESSIONID=SD55L7FF6ADFF9" "Opera/9.80.2010.13003.08859; en-US; rv:1.9.5.13" Gecko/20100227 Firefox/3.5.108859; en-US; rv:1.9.5.13"
//buttercup-shopping.com/category.screen?category_id=FLOWERS&JSESSIONID=SD55L7FF6ADFF9 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/category.screen?category_id=FLOWERS&JSESSIONID=SD55L7FF6ADFF9" "Opera/9.80.2010.13003.08859; en-US; rv:1.9.5.13" Gecko/20100227 Firefox/3.5.108859; en-US; rv:1.9.5.13"

```



Click the link to go to Welcome Page
Click the link to go to Network Traffic Forecasting



C-RAN Manager

Datacentre: London

Site Cluster: *

Group	Datacentre	Site Cluster
Group 5	London	Southend-on-Sea Brighton Luton Norwich Peterborough Ipswich Cambridge Dover

Site Cluster Status - Utilization

site cluster	utilization	sparkline
Edinburgh	91.15%	
Oxford	90.93%	
Portsmouth	90.89%	
Kirkwall	90.85%	
Stoke	90.84%	
Luton	90.76%	
Dover	90.74%	
Nottingham	90.71%	
Newcastle	90.65%	
Wick	90.60%	

Site Cluster Status - Network Latency

site cluster	network latency	sparkline
Portsmouth	487.46 (ms)	
Southampton	446.42 (ms)	
Reading	321.54 (ms)	
Bath	312.17 (ms)	
Bristol	306.23 (ms)	
Londonderry	247.51 (ms)	
Oxford	226.09 (ms)	
Omagh	215.71 (ms)	
Leicester	140.00 (ms)	

Datacentre Status - Utilization

site cluster	utilization	sparkline
Belfast	87.90%	
Manchester	87.12%	
Birmingham	86.93%	
Leeds	86.92%	
Glasgow	86.88%	
Cardiff	86.54%	
Aberdeen	76.38%	
London	43.62%	

Datacentre Status - Network Latency

site cluster	network latency	sparkline
Birmingham	30.56 (ms)	
Belfast	30.39 (ms)	
Glasgow	8.63 (ms)	
London	8.62 (ms)	
Cardiff	8.62 (ms)	
Aberdeen	7.31 (ms)	
Manchester	7.31 (ms)	
Leeds	7.31 (ms)	

London KPI

Medium

Site Cluster	KPI
Brighton	Low
Cambridge	Medium
Dover	Low
Ipswich	Low
Luton	Low
Norwich	Medium
Peterborough	Low
Southend-on-Sea	Medium

Site Cluster KPI :: London

Site Cluster	KPI
Brighton	Low
Cambridge	Medium
Dover	Low
Ipswich	Low
Luton	Low
Norwich	Medium
Peterborough	Low
Southend-on-Sea	Medium

London Utilization Rate (%)

52.5%

Site Cluster Utili :: London

Site Cluster	Utilization (%)
Brighton	88.83%
Cambridge	75.67%
Dover	91.50%
Ipswich	88.17%
Luton	91.25%
Norwich	88.80%
Peterborough	92.00%
Southend-on-Sea	87.67%

London Network Latency

8.64 (ms)
Compared to 15 minutes ago

Site Cluster Latency :: London

Site Cluster	Network Latency	sparkline
1 Brighton	27.908333	
2 Cambridge	28.358333	
3 Dover	38.670000	
4 Ipswich	40.248333	
5 Luton	17.000000	
6 Norwich	57.348000	
7 Peterborough	44.486667	
8 Southend-on-Sea	20.961667	

C-Suite Portal

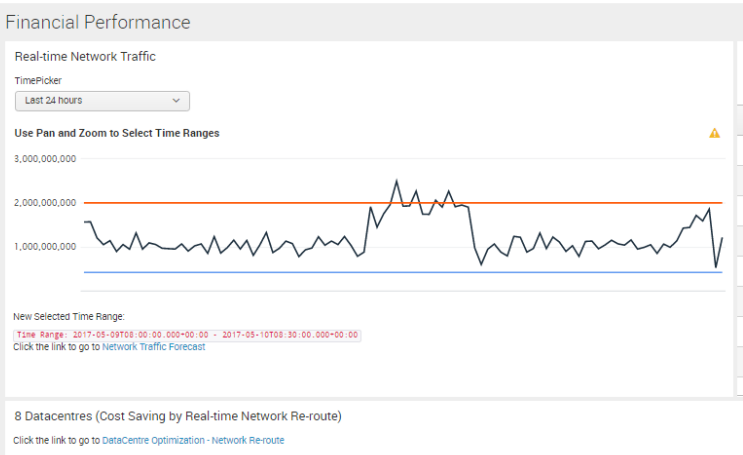
- ▶ Integrates network performance information with financial performance to support executive's decision-making.



```
130.60.4 - - [07/Jan 18:10:57:153] "GET /category.screen?category_id=GIFTS&JSESSIONID=SD1SLAFF10ADFF10 HTTP/1.1" 404 720 "http://buttercup-shopping.com/cart.do?action=view&itemId=EST-6&product_id=FL-SW-01" "Opera/9.80.20
128.241.220.82 - - [07/Jan 18:10:57:123] "GET /product.screen?product_id=FL-DSH-01&JSESSIONID=SD55L7FF6ADFF9 HTTP/1.1" 200 1316 "http://buttercup-shopping.com/category.screen?category_id=EST-20&product_id=K9-CU-01" "Compaq/10.14.14.14
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/buttercup-shopping_id=RP-LI-02" "Opera/9.80.2011.14.14.14
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```

Click the link to go to Welcome Page
 Click the link to go to Network Traffic Forecast
 Click the link to go to DataCentre Optimization - Network Re-route
 Click the link to go to DataCentre Optimization - Network Performance Driven
 Click the link to go to DataCentre Optimization - Network & Financial Performance Driven

Choose a view
 Network Performance View
 Financial Performance View

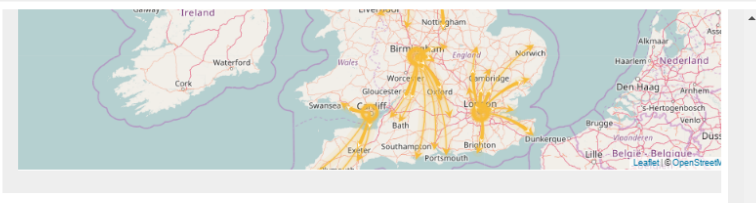
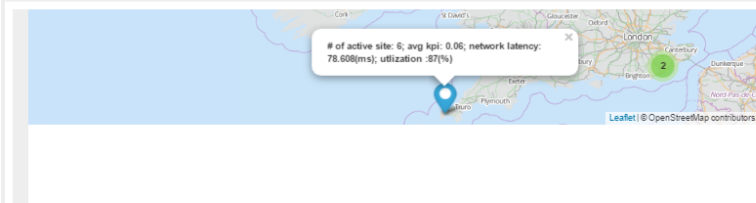


8 Datacentres Real-time Cost Breakdown

Optimization Baseline

	Datcentre	Demand	Size	AVG Util	MAX Util	Estimated Energy Base Charge	Estimated Energy Running Cost	Estimated Total Energy Cost
1	Belfast	19779	10000-20000	0.64	0.86	£ 80,000.00	£ 332,296.00	£ 412,296.00
2	Birmingham	27791	20000-30000	0.58	0.89	£ 120,000.00	£ 506,334.00	£ 626,334.00
3	Aberdeen	12534	10000-20000	0.74	0.90	£ 80,000.00	£ 349,170.00	£ 429,170.00
4	Cardiff	18387	10000-20000	0.59	0.87	£ 80,000.00	£ 335,379.00	£ 415,379.00
5	Glasgow	37021	30000-40000	0.66	0.89	£ 160,000.00	£ 674,456.00	£ 834,456.00
6	London	63775	60000-70000	0.71	0.88	£ 280,000.00	£ 1,195,236.00	£ 1,475,236.00
7	Leeds	29299	20000-30000	0.69	0.89	£ 120,000.00	£ 515,457.00	£ 635,457.00
8	Manchester	19630	10000-20000	0.74	0.88	£ 80,000.00	£ 351,540.00	£ 431,540.00
9								£ 5,259,868.00

8 Datacentres (Cost Saving by Real-time Network Re-route)
 Click the link to go to DataCentre Optimization - Network Re-route



C-Suite Portal

Datcentre: London

Site Cluster: *

Group: Group 5, Datcentre: London, Site Cluster: Southend-on-Sea, Brighton, Luton, Norwich, Peterborough, Ipswich, Cambridge, Dover

London KPI

Medium

Site Cluster KPI :: London

Brighton	Medium
Cambridge	High
Dover	Medium
Ipswich	Medium
Luton	Medium
Norwich	Medium
Peterborough	Low
Southend-on-Sea	Medium

London Utilization Rate (%)

51.89%

Site Cluster Util :: London

Brighton	90.22%
Cambridge	71.11%
Dover	87.60%
Ipswich	88.56%
Luton	90.83%
Norwich	89.17%
Peterborough	90.60%
Southend-on-Sea	83.33%

London Network Latency

8.55 (ms) 8.55
 Compared to 15 minutes ago

Site Cluster Latency :: London

Site Cluster	Network Latency	sparkline
1 Brighton	26.881111	
2 Cambridge	29.055556	
3 Dover	38.582000	
4 Ipswich	39.598800	
5 Luton	17.333333	
6 Norwich	57.288333	
7 Peterborough	43.380000	
8 Southend-on-Sea	21.161111	

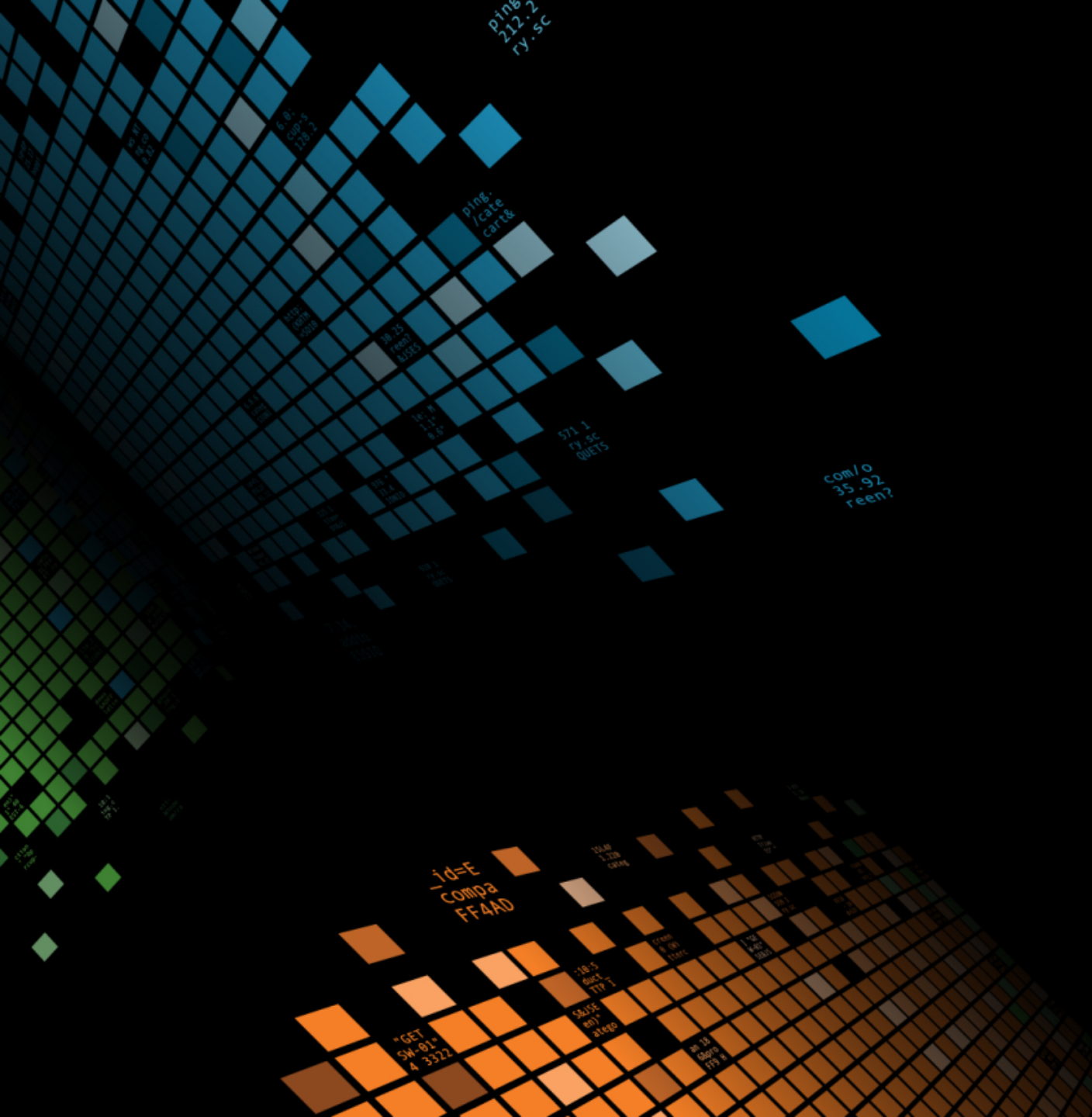
8 Datacentres (Cost Saving by Real-time Network Re-route)
 Click the link to go to DataCentre Optimization - Network Re-route

Datcentre	Demand	Size	AVG Util	Target Util	MAX Util	Estimated Energy Base Charge	Estimated Energy Running Cost	Estimated Energy Running Cost (Target)	Estimated Total Energy Cost	Estimated Total Energy Cost (Target)	Target Savings	Target Savings (%)
Belfast	19967	10000-20000	0.64	0.67	0.86	£ 80,000.00	£ 340,518.00	£ 239,134.00	£ 420,518.00	£ 279,134.00	£ 141,384.00	33.6%
Birmingham	28067	20000-30000	0.58	0.67	0.88	£ 120,000.00	£ 512,244.00	£ 444,345.00	£ 632,244.00	£ 564,345.00	£ 67,900.00	10.7%
Aberdeen	12639	10000-20000	0.74	0.67	0.89	£ 80,000.00	£ 357,114.00	£ 307,847.00	£ 437,114.00	£ 387,847.00	£ 49,267.00	11.3%
Cardiff	18533	10000-20000	0.59	0.67	0.86	£ 80,000.00	£ 333,906.00	£ 293,326.00	£ 413,906.00	£ 373,326.00	£ 40,580.00	9.8%
Glasgow	37363	30000-40000	0.66	0.67	0.88	£ 160,000.00	£ 716,472.00	£ 621,503.00	£ 876,472.00	£ 781,503.00	£ 94,969.00	10.8%
London	64338	60000-70000	0.71	0.67	0.88	£ 280,000.00	£ 1,265,544.00	£ 1,097,794.00	£ 1,545,544.00	£ 1,377,794.00	£ 167,750.00	10.8%
Leeds	29590	20000-30000	0.69	0.67	0.88	£ 120,000.00	£ 542,376.00	£ 470,483.00	£ 652,376.00	£ 590,483.00	£ 61,893.00	9.5%
Manchester	19799	10000-20000	0.74	0.67	0.88	£ 80,000.00	£ 368,280.00	£ 319,464.00	£ 448,280.00	£ 399,464.00	£ 48,816.00	10.9%
									£ 4,436,454.00	£ 4,853,896.00	£ 582,558.00	10.72%

11 Datacentres (Network Performance Driven)

10 Datacentres (Network Performance + Cost Efficient)

Technical Highlights



The Best Bits

Data Visualization

- ▶ Splunk's web framework enabled us to create a customized dashboard view
- ▶ Integrates with D3.js to create stunning dashboards and leaflet API which creates interactive map views
- ▶ Ample visualization components available in Splunkbase

The grid displays various visualization types:

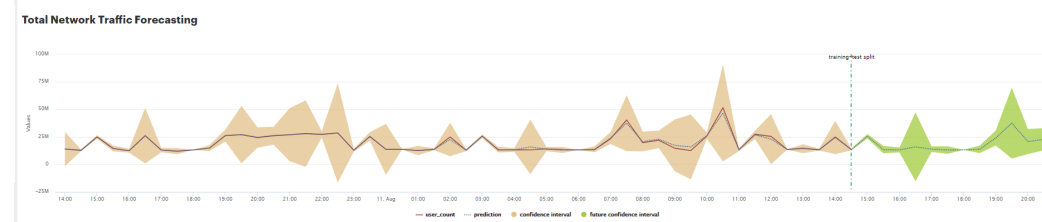
- Tag Cloud**: Add search-driven, custom visualizations to a dashboard, using JavaScript.
- Tag Cloud with Base Search**: Use the new top-level search element in 6.2 and connect it to your custom visualization.
- Tag Cloud with Tokens**: Example on how to use token-replacement in combination with custom visualizations.
- Punchcard**: Punchcards can visualize cyclical trends in your data, showing a given metric aggregated over two dimensions.
- Horseshoe Meter**: Use a horseshoe meter to gauge metric changes against a set of ranges or a target value.
- Status Indicator**: Status indicators provide information at a glance, showing a given value and icon.
- Treemap**: Treemaps divide a single space into multiple rectangles to show data values and category relationships.
- Location Tracker**: Location Tracker shows the current location of one or more individual resources in real time.
- Location Tracker**: Parallel coordinates are used to show multidimensional patterns in a data set.
- Timeline**: Timeline visualization shows activity time intervals and discrete events for a resource set.
- Bullet Graph**: Bullet graphs are used to show a given key performance indicator (KPI) and its contextual markers.
- Horizon Chart**: Horizon charts show metric behavior over time in relation to a baseline or horizon.
- Sankey Diagram**: Sankey diagrams show metric flows and category relationships, visualizing density and trends.
- Calendar Heat Map**: Calendar Heat Map shows relative metric density over a configured time span.
- Custom Decorations**: Insert icon sets based on a value rangemap, for a visualization built using HTML elements.

```
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<viz type="cuviz_water_gauge.water_gauge">
<viz type="geo_heatmap_app.geo_heatmap">
<viz type="horizon_chart_app.horizon_chart">
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<viz type="viz_halo.halo">
<viz type="wordcloud_app.wordcloud">
```

This section features several advanced visualizations:

- Gauge Chart**: A green circular gauge showing a value of 77.84%.
- Network Graph**: A graph titled "Dijkstra's algorithm" showing a network of nodes and edges with a highlighted path.
- Map with Arrows**: A map showing a network of green arrows connecting various locations.
- DTree**: A visualization of a decision tree structure.
- Flow Diagram**: A complex diagram showing a dense network of lines and nodes, representing data flow or relationships.

The R Square Statistic Goodness of Fit **✓ 0.979**



Machine Learning

- ▶ To build our own time series forecasting algorithms to forecast network service demand over time
- ▶ Decision tree algorithms to suggest how many data centres are needed and where they should be
- ▶ To create customized algorithm with Splunk ML Toolkit(i.e. Dijkstra's algorithm to calculate the best network reroute path)

A Learning Network

- Anomaly Detection Algorithms
- Decision Tree Algorithms
- Dijkstra's Algorithms
- Time Series Forecasting Algorithms

Decision tree learning

	Datcentre	Status	Dtree	lat	lng
1	London	Old DC	predicted_dc	51.49999473	-0.116721844
2	Birmingham	Old DC	predicted_dc	52.47497398	-1.919996787
3	Manchester	Decom		53.50041526	-2.247987103
4	Leeds	Old DC	predicted_dc	53.83000755	-1.580017539
5	Glasgow	Old DC	predicted_dc	55.87440472	-4.250707236
6	Liverpool	New DC	predicted_dc	53.41600181	-2.917997886
7	Cardiff	Old DC	predicted_dc	51.49999473	-3.22500757
8	Bradford	New DC	predicted_dc	53.80003522	-1.749981325
9	Belfast	Old DC	predicted_dc	54.60001223	-5.960034425
10	Aberdeen	Old DC	predicted_dc	57.17039797	-2.079987021
11	York	New DC	predicted_dc	53.97038658	-1.080022218

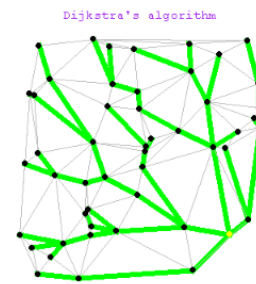
[Click the link to go to Dtree Prediction Analysis](#)

- ▶ How to run customized python algorithm:
- ▶ Register the algorithm
- ▶ Create the algorithm python script file
- ▶ Write an algorithm class

Datcentre Source Picker

[Display Datcentre Details](#) [Hide Table](#)

[Click on Datcentre Details Table link above to show site -> datcentre information.](#)



Optimized Traffic Re-routing

Cloest Datcentre: Most Avilable:

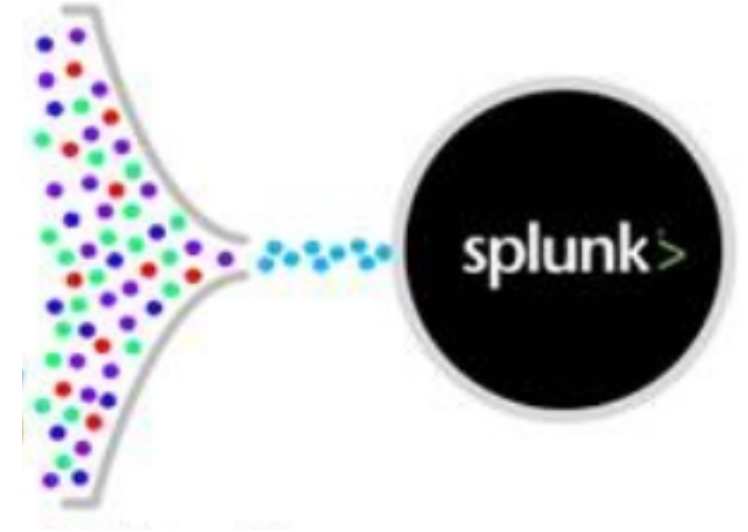


The Best Bits

Real Time Data

- ▶ Due to the complexity of network infrastructure, it is very difficult to collect real-time data from various endpoints. As an end-to-end solution, Splunk's ability to collect, parse and index terabytes of data from various network devices and endpoints regardless of the data type in real-time is tremendously valuable.

- ▶ Various Network Data sources can be integrated with Splunk:
- ▶ Network Performance Management (i.e. Cisco Element Manager, OSS)
- ▶ Billing System
- ▶ Alarm logs
- ▶ Support tickets
- ▶ Marketing Tools (i.e. CRM, salesforces)
- ▶ External data (i.e. social media feeds)

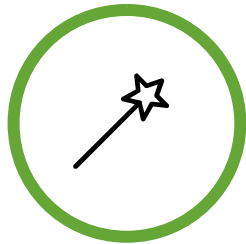


130.60.4 - - [07/Jan 18:10:57:153] "GET /category.screen?category_id=GIFTS&JSESSIONID=5D15LAF10ADFF10 HTTP 1.1" 404 720 "http://buttercup-shopping.com/cart.do?action=view&itemId=EST-6&product_id=F1-5W-01"
128.241.220.82 - - [07/Jan 18:10:57:123] "GET /product.screen?category_id=FL-DSH-01&JSESSIONID=5D35L7FF6ADFF0 HTTP 1.1" 404 3322 "http://buttercup-shopping.com/cart.do?action=purchase&itemId=EST-268product_id=K0-CB-01"
ows NT 27.160.0.0 - - [07/Jan 18:10:56:156] "GET /oldlink?item_id=EST-26&JSESSIONID=5D55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST-18&product_id=AV-CB-01&JSESSIONID=5D55L9FF1ADFF3"
:/buttercup-shopping_id=RP-LI-02" 468 125.17 14.11 "screen?category_id=FLOWERS&JSESSIONID=5D55L9FF1ADFF3 HTTP 1.1" 200 3865 "http://buttercup-shopping.com/cart.do?action=remove&itemId=EST-18&product_id=AV-CB-01&JSESSIONID=5D55L9FF1ADFF3"
:/buttercup-shopping.com/cart.do?action=purchase&itemId=EST-26&product_id=K0-CB-01&JSESSIONID=5D55L9FF1ADFF3 HTTP 1.1" 200 1318 "http://buttercup-shopping.com/cart.do?action=changequantity&itemId=EST-18&product_id=AV-CB-01&JSESSIONID=5D55L9FF1ADFF3"

Conclusion

Conclusion

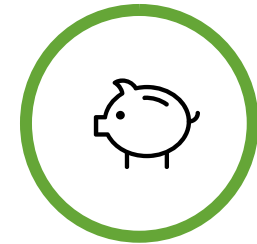
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CUSTOMER
EXPERIENCE**



**LOWER
OPERATIONAL
COSTS**



**LOWER CAPITAL
INVESTMENT**



WIN, WIN, WIN!

Thank You

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