Prodapt Chase Extraordinary

Making smarter network investment decisions

Build an open-source network capacity planning framework to accelerate the network decisions by 3X

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DSPs are challenged by complex networks, dissimilar data and inefficient visualization of logical & physical inventory which impacts their network capacity planning

Major challenges
in the conventional network capacity planning service process

Complexity in the DSPs' network

Rapid network expansion, among other factors, has caused data silos in Digital Service Providers (DSPs), which affects time-to-insights for their data assets & hence poses a challenge to plan the network efficiently

Difficulty in visualizing the rapidly changing DSPs' network

DSPs' networks are subject to expansion as the business grows. Due to this high volatility, it becomes incredibly difficult to visualize and monitor networks and their components for capacity planning

Challenges in unifying a large set of dissimilar network inventory data

Most often DSPs' network inventory data is scattered and is retrieved from different types of vendor network equipment, thus making it difficult to consolidate them for efficient planning

Lack of a single network visualization

DSPs have multiple systems with multiple vendors and integrations. Thus, making it difficult to visualize complex network data on a single platform

Increased cost to the DSPs

Most DSPs who use COTS products for network visualization incur huge licensing, hardware and customization costs

How this impacts DSPs' operations?

- Ineffective network capacity planning
- Delay in new network design and rollout
- Errors in assessing impact of network outages
- Inefficient network and resource utilization

Typical approaches employed by DSPs to enable efficient network capacity planning

Standard COTS products approach

Advantage

Quick to implement

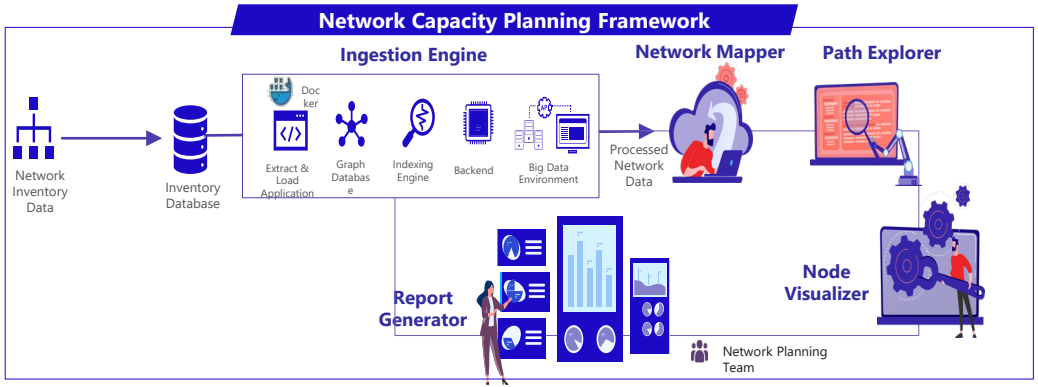
Complexity

- With constantly changing network infrastructure, COTS products often require changes to be implemented, which results in additional costs
- Software licensing costs per node is high
- Selecting best-of-breed from different vendors often results in vendor lock-in. Over the time, this becomes an extremely fragmented and scattered approach

Open-source approach

Open-source approach enables DSPs to efficiently plan network capacity with

- **Reduced hardware cost**
- **No licensing cost**
- **No vendor-lock in**

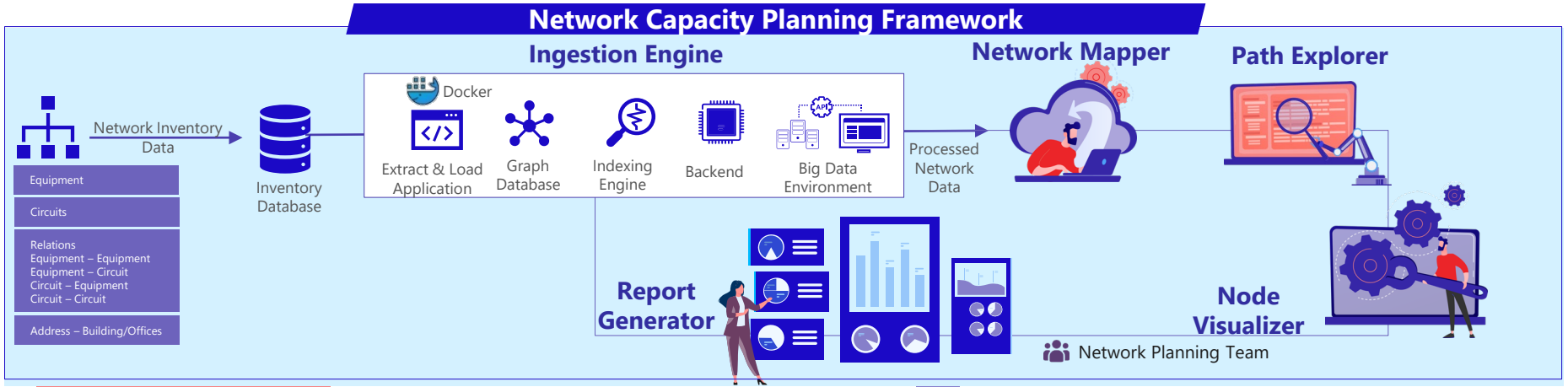


Advantages

- Collects inventory data from multiple sources like OSS, NMS, etc. into a single platform for the network to reduce swivel-chair operations
- Enables rapid implementation and configuration with low-code platform, in contrast to the expensive and highly customized solutions
- Eliminates costs and delays
- Ideal for scenarios where the DSP would like to solve the network visualization problems without any additional vendor tools & systems

This insight details how DSPs could build an ***open-source framework*** to ease and accelerate network capacity planning decisions

Move to a highly available, scalable & **open-source Capacity Planning Framework** for efficient network capacity planning and accelerating your network capacity decisions by 83%



With these 4 key enablers, DSPs can achieve quick identification of network visualization, better capacity utilization, and easy troubleshooting

1. **Ingestion Engine** Uses big data to process scalable and distributed databases
2. **Network Mapper** Displays capacity utilization through color-coding
3. **Path Explorer** Provides quick glance at the best, optimum & less loaded network paths
4. **Node Visualizer** Simplifies and provides user-friendly network equipment hierarchy

Implement an efficient **Ingestion Engine** to build the network inventory data in the graph database

Enables network planning team with deeper network visualization and insights

Ingestion Engine | Network Mapper | Path Explorer | Node Visualizer | Report Generator

1 **Implement an efficient extract and load application using tools like Scala or Spark to pull relevant data from inventory systems and build the network relationships and logic**

2 **Ensure physical & logical inventory data and location information are loaded into the graph database**

3 **Use open-source, scalable, distributed graph databases like Janus Graph to store and query graphs with tailor-made user requirements**

- Use Graphical Query Language (GQL) for retrieval of data in a hierarchical representation

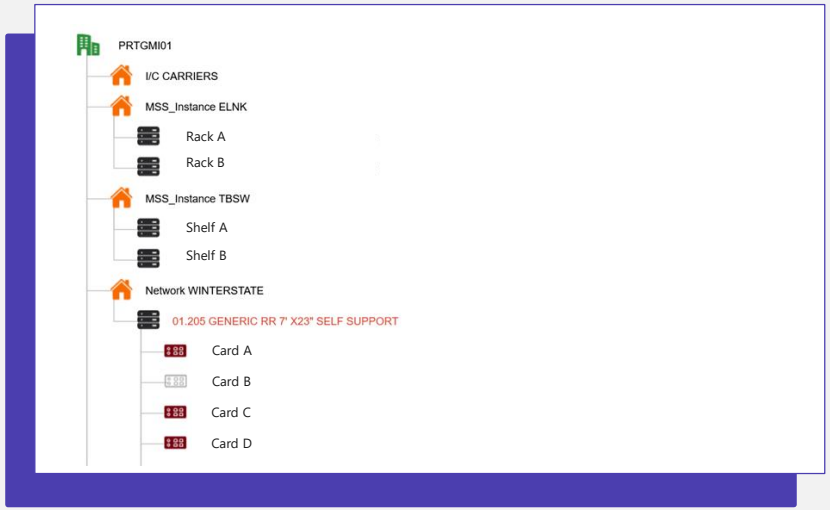


Fig: Hierarchical Representation of Network Components

4 **Leverage indexing engines like Elasticsearch, Altas Search, Arango DB to enable capacity planning team with faster retrieval of data and maintain consistency**

- Implement indexing methods like elastic search (indexing backend), full-text search (search via words), and string search (search via entire string value) to enable flexibility in search methods

5 **Use open-source, distributed, wide-column store, NoSQL database management system like Cassandra, Snowflake, Redis for high data availability & partition tolerance**

- Handles large amounts of data, providing 24x7 data high availability even in case of any failure
- Removes any redundant node from a cluster with partition tolerance
- Provides optimum backend support for faster retrieval and data consistency

6 **Enable parallel-processing or multi-threading to reduce the ingestion time**

7 **Dockerize the environment to enable CI/CD pipeline for increasing the availability of network data**

- Ensures quicker installation of docker, deployment of applications, and spin, improving the processing speed

Implement **Network Mapper** function to display capacity utilization through color-coding

Enables capacity planning team to instantly spot congestion or underutilization

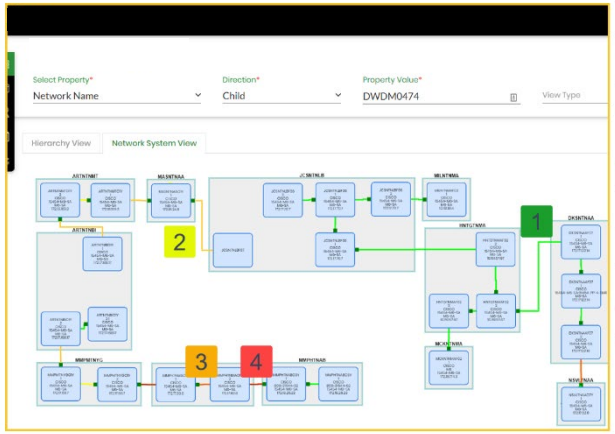


Fig: Capacity Color-Coding

Ingestion Engine | **Network Mapper** | Path Explorer | Node Visualizer | Report Generator

1

Allocate colors to identify the capacity of the network path

- Red: for paths where capacity is from 80% to 100%
- Orange: for paths where capacity is from 70% to 80%
- Yellow: for paths where capacity is from 60 to 70%
- Green: for paths where capacity is less than 50%

2

Based on the path type (less loaded or more loaded), the capacity planning and engineering team shall make decisions

- For more occupied paths, networks can be shared to reduce traffic
- For less occupied paths, decisions can be made to introduce new networks
- Identifies the number of circuits on an equipment
- Recover the equipment parts for re-use/redeployment in the network

- **Tightly integrate location information with physical and logical network inventory for efficient network mapping**
- **Ensure capacity utilization information is updated on the graph database near-real-time (at pre-defined intervals) for achieving efficient capacity coloring**

Build a **Path Explorer** to provide efficient and detailed network path visualizations

Enables network planning team to identify currently available, shortest and unused paths – to reorganize and optimize networks

Ingestion Engine | Network Mapper | **Path Explorer** | Node Visualizer | Report Generator

Key considerations for building an effective path explorer

1. **Path analysis** to determine the shortest path between location A to Z
   - Determine the number of hops needed between the locations
   - Determine whether the path is owned or leased by another vendor
2. **Node capacity analysis** to determine the utilization or loading of the equipment & route
3. **Port availability analysis** to determine the bandwidth of ports

Key capabilities of path explorer

- Make decisions on re-routing the circuits, creating new nodes and capacity
- Implement the decisions based on inputs from path explorer for creating an engineering work request
- Visualize shortest paths using tabular and map views to view capacity statistics
- Avoid route based on cost-effectiveness
- Filter the path based on -
  - Rate codes like 1GB, 1TB, etc.
  - Network types like DWDM, SONET, VDSL, etc.
  - Circuit status like active, inactive, etc.

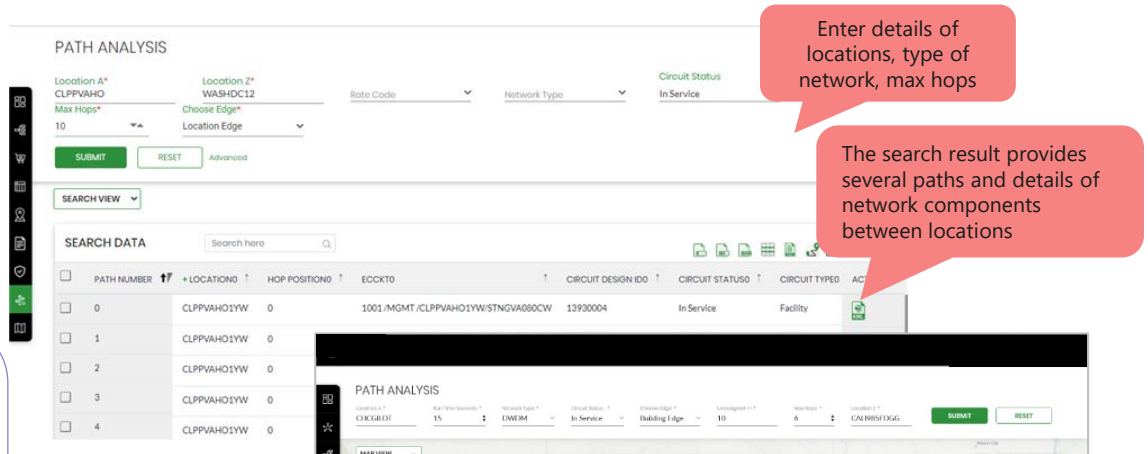


Fig : Horizontal Path Visualization

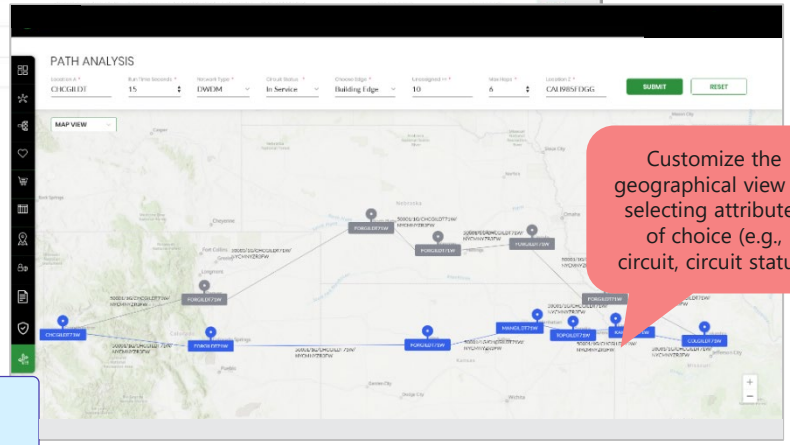


Fig: Geographical Path Visualization

Recommendation **Build inventory database mapped in relationship format leveraging Graph DB, to enable path explorer implementation**

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Build a **Node Visualizer** function to provide real-time information about network equipment utilization in a hierarchical view

Enables network planning team to make quicker capacity refinement decisions

Ingestion Engine | Network Mapper | Path Explorer | **Node Visualizer** | Report Generator

1 **Use node hierarchy visualization (from parent to child element) to simplify complex network components**

- Ingest RDBMS relationship to visualize the hierarchical group network equipment
- Use edge insights to see end-to-end relationships & hierarchy using graph database

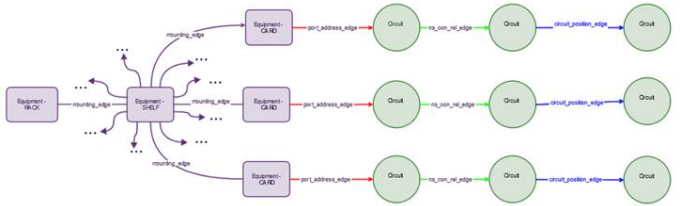

Fig: Complex Network Relationship

2 **Node visualization helps the network capacity planning and engineering team to determine -**

- Complete **status** of network ports like assigned, unassigned, active, suspend, de-active, repair
- The **affected child,** in case of any incidents/outages and proactively curb them
- **Statistics** like equipment, rack, shelf, port and, power consumption

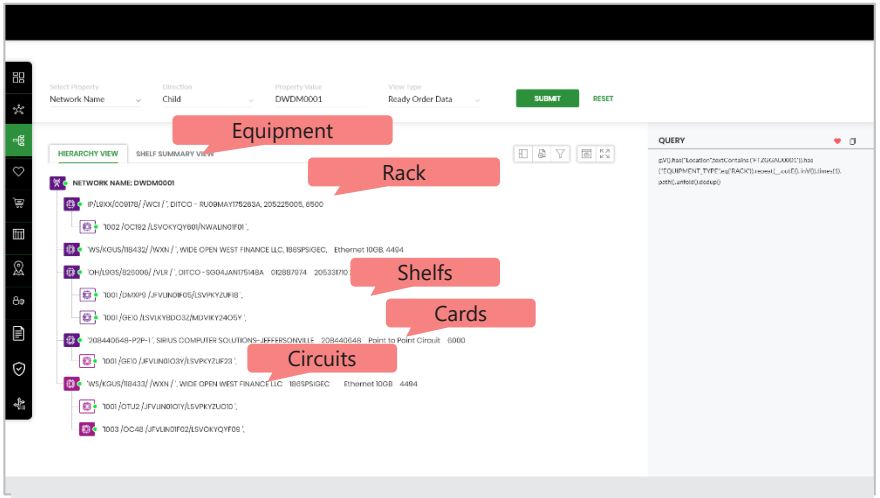

Fig: Simplified Network Hierarchy with Parent- Child Analysis

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Build automated **Report Generator** to help the network team make the data-driven decisions

Enables planning & operations team to make decisions faster

Ingestion Engine | Network Mapper | Path Explorer | Node Visualizer | Report Generator

NETWORK ID	NETWORK NAME	NETWORK TYPE	COMPONENT LOCATION ID	COMPONENT LOCATION A	LAT DEGREES	LON DEGREES	PARENT LOCATION ID2	SNA PATH1	UNASSIGNED	PENDING INSTALL	IN_SERVICE	PENDING REMOVAL	RESERVED	
NS6372	IL GEN U 4463	ETHERNET	117015	CHCGILDTO1Z	47.54684	-107.77431	7661	1-1-5	0	0	0	0	0	
NS9277	PTP2F7181	SONET	116950	CHCGILDTF12	41.85227	-87.62262	7661	1-12-1	42	0	6	0	0	
NS8803	IA GEN U 11105	ETHERNET	117015	CHCGILDTO1Z	47.54684	-107.77431	65190	1-1-6	0	0	0	0	0	
NS7292	BB ACCESS IL	BROADBAND	117027	CHCGILDTO5Z	41.85634	-87.61971	7661	UKN						
NS11262	DWDM4625	DWDM	117019	CHCGILDTO2Z	41.85634	-87.61971	7661	UKN	9	1	30	0	0	0
NS8591	UPSR2F5041	SONET	117020	CHCGILDTO3A	41.85634	-87.61971	45374	0-IFA1-1-1	173	1	18	0	0	0
NS12083	IL GEN U 4646	ETHERNET	117015	CHCGILDTO1Z	47.54684	-107.77431	7661	1-1-1	0	0	0	0	0	0
NS7292	BB ACCESS IL	BROADBAND	116921	CHCGILDT4RW	47.54684	-107.77431	7661	UKN	0	0	0	0	0	0
NS10899	CXP0001	OPTICAL	117004	CHCGILDTO00	47.54684	-107.77431	7661	1-	0	0	50	0	0	0
NS7292	BB ACCESS IL	BROADBAND	116920	CHCGILDT3RW	47.54684	-107.77431	7661	UKN	0	0	0	0	0	0
NS1942	UPSR2F0723	SONET	116942	CHCGILDTF02	41.85227	-87.62262	55392	1-5-1	60	0	131	1	0	0
NS7599	DWDM0785	DWDM	117035	CHCGILDTO9Z	41.85227	-87.62262	7661	UKN	88	0	0	0	0	0
NS7599	DWDM0785	DWDM	117035	CHCGILDTO9Z	41.85227	-87.62262	55379	15-4	78	0	10	0	0	0
NS11627	MN BB CS	ETHERNET	98783	BGLKMNXA7RW	45.33556	-93.74194	7661	UKN	0	0	0	0	0	0
NS9184	IL GEN U 10806	ETHERNET	117015	CHCGILDTO1Z	47.54684	-107.77431	7661	1-4-4	0	0	0	0	0	0

Network systems report identifies shortest path between location A to Z along with their network details and status

CIRCUIT DESIGN	CIRCUIT STATUS	CIRCUIT TYPE	RATE CODE	LOCATION A	LOCATION Z	CIRCUIT STATUS
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVIC
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVIC
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVIC
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVIC
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVIC
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVICE
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVICE
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVICE
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVICE
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVICE
16594871	IN SERVICE	FACILITY	100 GB	ATLNGAMA	FTZGGAXA5	IN SERVICE

Circuit hierarchy report (parent-child) identifies currently available circuits to reorganize and optimize networks

1 **Identify most used reports by Network Design Center, Network Optimization, Transport Engineering, Circuit Design, Sales Engineering, and NOC teams to automate**

2 **Some of the widely downloaded reports include –**

- Circuit hierarchy report (parent-child)
- Equipment hierarchy report (parent-child)
- Network systems report

3 **Automate the complex and heavy reports for sending by mail**

- Use microservices to **auto-schedule** reports if the run time to generate reports is more than **6 sec**
- Enable **add cart** feature to add network components for quick reference
- Implement **wildcard search** for multi-search combinations to improve network relations

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Benefits achieved by a leading DSP in North America after implementing the Network Capacity Planning Framework

83% faster network capacity expansion decisions

One-click network visualization

Better capacity utilization

Easy troubleshooting

Time, effort and cost savings

THANKS!

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