

# YOUR ENGINEERING PARTNER OF CHOICE FOR SOFTWARE DEFINED INNOVATION

TO HELP YOU EXECUTE  
WITH EXCELLENCE!

A CATALOGUE  
OF OUR  
SELECT  
CASE STUDIES

# ARE YOU LOOKING TO DESIGN, AUTOMATE OR MONETIZE YOUR NETWORKING PRODUCTS AND SOLUTIONS?

The rules of the game are being rewritten with disruptions like 5G, Edge Computing and SDWAN coupled with dramatic transformations in data centers. In addition, the rapid rise of VR and Autonomous vehicles necessitates the use of different architectures that are based on multi-cloud and edge computing models.

Although virtualized and software defined networks bring with them great upside, their full potential can only be realized through end to end orchestration and automation from the data centers to the edge. This is imperative to facilitate optimal network performance and improved user experience.

So, if you are looking to build SDN and NFV solutions with management and orchestration to achieve optimal network performance and improved user experience – we can help. Talk to us to know how we can help you by leveraging our capabilities in SDN, NFV, System Design, Software Development, Analytics, Testing and DevOps.

## WHO ARE HAPPIEST MINDS & WHY YOU SHOULD TALK TO US?

We are a Next Generation Digital Transformation, Infrastructure, Security and Product Engineering Services Company.



Launched in  
**August 2011**



Raised funding of  
**US\$ 63.3 Mn**



Our  
**Investors**

J.P.Morgan



Ashok Soota

**2400+ People**

**170+ Customers**

**16 Cities**

**8 Countries**

Happiest Minds Technologies is a company with investments from Intel Capital and JP Morgan, with a rich engineering pedigree. We have a digital mindset with a strong focus on 3rd Platform technologies like Cloud, Mobility, IOT, Big Data Analytics & Blockchain. We are committed to supporting OEMs, ISVs, Service Providers, Web Scale & Enterprises in the design, development and deployment of Software Defined Networking, Network Function Virtualization, Software Defined Storage & Cloud Storage while bringing all the 3rd Platform Technologies together to create a unique value proposition.

# LEVERAGING SDX TO HELP YOU CREATE NEXT GENERATION CONNECTED EXPERIENCES

Happiest Minds offers a full stack of end to end service offerings that help you leverage the power of software defined networking and network function virtualization to create robust networks and future ready connected products.

NFV Engineering Services	SDN Engineering Services	Network Engineering	Advanced Services
<ul style="list-style-type: none"><li>• VNF Development</li><li>• MANO</li><li>• Data Path Acceleration</li><li>• NFVi Engineering</li></ul>	<ul style="list-style-type: none"><li>• SDN Controller Engineering</li><li>• SDWAN Engineering and Portals</li><li>• Application Development</li></ul>	<ul style="list-style-type: none"><li>• Protocol Engineering</li><li>• Network Services</li><li>• NOS Integration</li><li>• Test Automation</li></ul>	<ul style="list-style-type: none"><li>• Multi Access Edge Computing</li><li>• Cloud Networking</li><li>• Container Networking</li><li>• NetOps</li><li>• Intent Based Networking</li></ul>

**Partner Ecosystem**



## EXPERIENCE THE DIFFERENCE WITH HAPPIEST MINDS

We are focused on using disruptive technologies like SDN & NFV as key building blocks while overlaying IoT and Analytics to help you create the next generation of connected experiences.

### Full Stack

Offerings right from Board Design to Analytics and AI



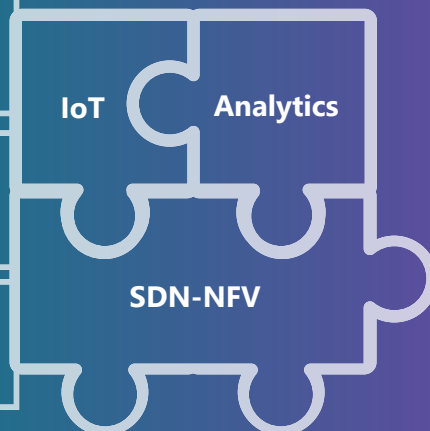
### Strong Ecosystem

with technology vendors, standard bodies & open source communities



### Technology Leadership

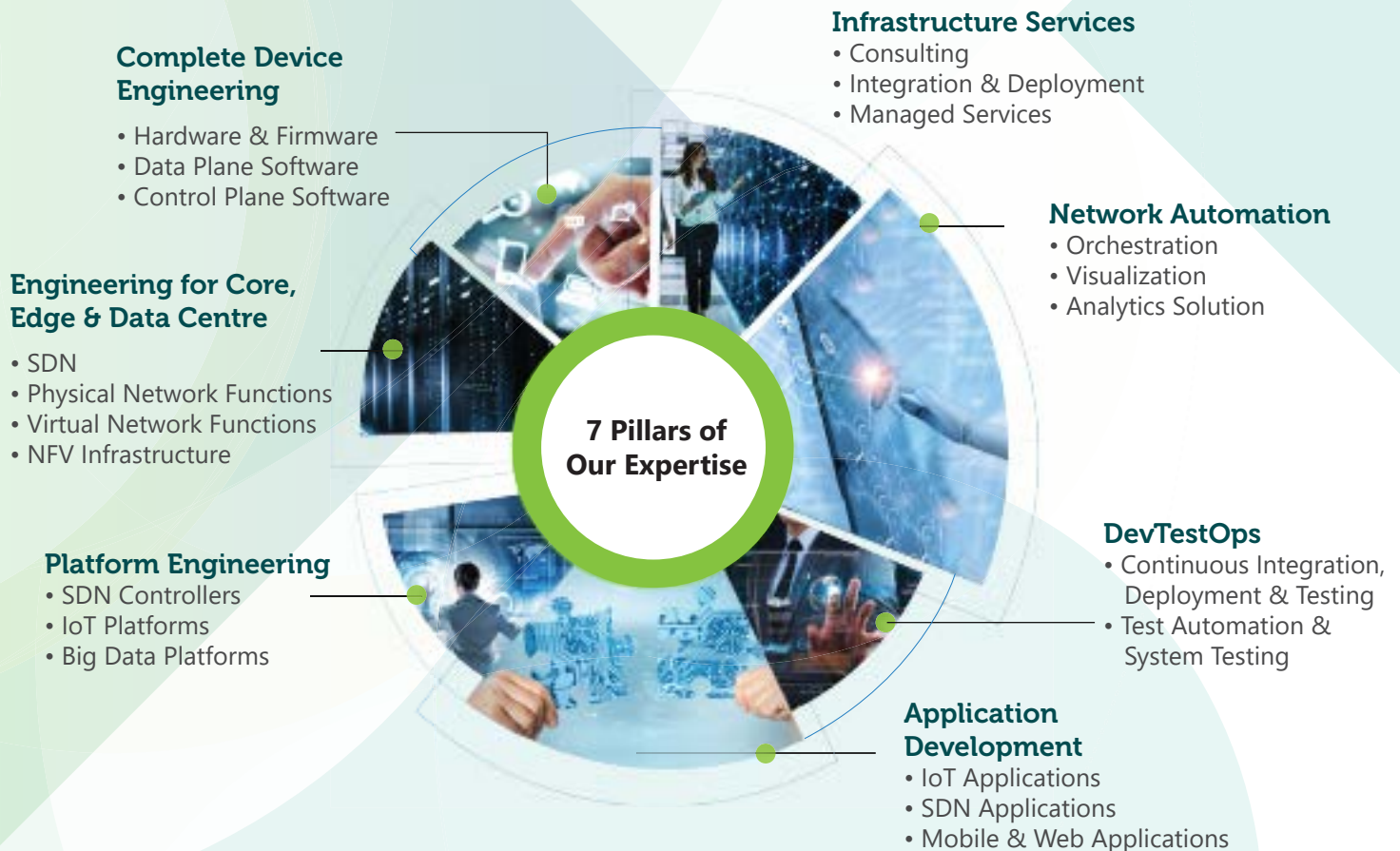
Investing ahead of the market in the technology stack



# UNLOCK THE POTENTIAL OF SOFTWARE DEFINED NETWORKS WITH OUR 7 PILLAR APPROACH

The expertise we bring to the table stretches across the entire spectrum from Device Engineering to Network Automation. Happiest Minds has deep expertise in developing SDN and NFV solutions based on open standards and interfaces to provide the desired intelligence in the network that makes it simple, agile, programmable and flexible.

With our approach, we at Happiest Minds work together with organizations in understanding their unique requirements to provide 'state of the art' product development using SDN, NFV, Cloud, IoT and Analytics.





The background is a complex digital composition. It features large, overlapping circles in shades of green and teal. Within these circles, there are patterns of fine lines and larger, semi-transparent circles. A network cable with a clear RJ45 connector is positioned diagonally across the center. The bottom left corner shows a blurred, horizontal streak of light in yellow and orange, suggesting motion or data flow.

# CASE STUDIES



# Creation of a Cloud Networking Solution using SONiC Framework

## CHALLENGE

The client was looking to build a switching OS based on an Open Source framework with Programmability that could work across multiple hardware platforms. This was to be based on a containerization approach to achieve serviceability and cross-platform portability and programmability.

## SOLUTION

Happiest Minds worked with the engineering team to develop a solution that included the following:

- Development of Network Applications like VxLan-EVPN, MAC Based VLAN to support advanced Data Centre and VPN functionality.
- Enhancing the SONiC core components to support the development of new applications.
- Integrating Happiest Minds Test Framework to achieve rapid test automation.

## TECHNOLOGIES LEVERAGED

C & C++, Python, Containers, Netlink, No-SQL, Redis-DB, JSON

**A leading Original Equipment Manufacturer targeting Cloud Providers**

### VALUE DELIVERED

Enabled leading white box vendor OEM to penetrate the data center and cloud provider market.

Reduced the testing cycle time and manual effort by automating the switch functionality.

Introduced, inculcated and transformed the engineering function to adopt Agile and DevOps principles.

# Development of a Unified Controller for managing heterogeneous devices

## CHALLENGE

The client was looking to develop a Unified Management and intelligent provisioning platform for managing heterogeneous devices. They were also looking for a centralized management console with a next-gen intent driven UI and advanced security features in a multi-tenant environment.

## SOLUTION

- We developed the intent driven management application with support for multiple protocols like SNMP, NETCONF, OpenFlow for heterogeneous devices.
- Robust architecture with symmetric design for Embedded EMS, EMS and NMS systems.
- Implemented TACACS, RADIUS and RBAC apart from other generic features such as FCAPS and ZTP.

## TECHNOLOGIES LEVERAGED

Open Daylight, Spring /Hibernate, ActiveMQ, Node.JS, Angular JS, Groovy/Postman

## VALUE DELIVERED

Happiest Minds provided a single solution that can manage both SDN and non-SDN hybrid devices thus creating a new market for brownfield or greenfield SDN deployments.

Enabled ease of configuration through intent based drag and drop.

Highly Responsive Single Pane of glass for monitoring and troubleshooting.

**A Tier-1 North American OEM of Packet Monitoring Systems**

# SDN Orchestrated Smart Home Services

## CHALLENGE

The client intended to offer value added services on their network to drive exponential revenue growth and increased average revenue per user (ARPU). As the client set about offering Smart Home Services, the challenge was to develop an SDN enabled Smart Home solution which would cater to more than 3 million homes in the Netherlands.

## SOLUTION

- Developed the IoT platform with an architecture to support more than 3 million homes while managing the smart home device ecosystem in residential areas.
- Developed an extensible and open interface to integrate several devices based on frameworks such as OpenHAB, Home Assistant, Demoticz etc.
- Integration with SDN controller for end to end orchestration and efficient network management
- End to end secured solution with API level Authentication /Authorization and TLS enabled southbound communication with gateways.
- Microservices based scalable and extensible design.

## TECHNOLOGIES LEVERAGED

OpenStack, Open Day Light, OpenHAB, OpenWRT, Apache Storm, Kafka, Redis

One of Europe's  
leading  
Telecommunication  
Services Provider

## VALUE DELIVERED

The client could tap into a timely business opportunity by providing Smart Home services in more than 3 million homes.

The solution met the availability goal of 99.9% with the ability to handle 30,000+ requests per second greatly enhancing the user experience.

The extensible design led to enhancing the framework to launch Smart Office solutions as well.





# Creation of Unified Threat Management (UTM) as a Service

## CHALLENGE

The client intended to introduce a new product targeted towards small businesses that provided Unified Threat Management (UTM) as a Service. The product needed to be based on a COTS platform to keep the cost low considering the target market.

## SOLUTION

- We developed the software using containerized network functions, chained and DPDK accelerated and deployed on x86 based COTS Hardware.
- Developed a microservices based scalable cloud security controller.
- Put in place a session based symmetric-key authentication & PKI based robust security system to guard against any man-in-the-middle attack.

## TECHNOLOGIES LEVERAGED

Python, C, Microservices, Spring Boot, DPDK, MQTT, RabbitMQ, Postgresql, AngularJS, Zuul, Eureka, Chart JS

## VALUE DELIVERED

The scalable and multi-tenant platform created by Happiest Minds enabled the client to effectively penetrate the small businesses market.

The Containerized Network Functions and Service Chaining enabled flexible services with high performance and lower costs.

**North America based  
Tech Start Up  
focused on Security**



# Development of an Analytics enabled SDWAN Solution

## CHALLENGE

The client was looking to create a solution intended for trading and financial houses. This SDWAN solution was to provide multi-tenant SDWAN orchestration with advanced analytics for optimal performance and low latency.

## SOLUTION

- Developed a prototype of an SDWAN solution using Open Source Technologies for Proof of Concept.
- Software integration of the commercial solution (Cisco Viptela).
- Developed the SDWAN Orchestration Portal with features such as:
  - Network Service Management
  - Identity & Access Management
  - Administration of Organizations and Users
  - Health Monitoring, Statistics and Troubleshooting
- Built an enhanced analytics platform by integrating the network data from the application delivery stack and the application environment making it easier to identify the correlations and root causes of issues like latency, packet loss, and jitter across these disparate systems.

## TECHNOLOGIES LEVERAGED

Angular JS, Twitter Bootstrap, OpenStreet Maps, Grafana for visualization, Gluu for IAM, Prometheus for Time series data, Kong API gateway, ELK Stack, Statsmodels

**A pioneer in  
low-latency  
networks for  
financial exchanges  
in the US**

## VALUE DELIVERED

Enabled the client to provide SDWAN as a managed service resulting in increased revenues by leveraging the existing network infrastructure.

Efficient network operations and management by proactive traffic steering based on QoE predictions through Analytics.

Single Pane of Glass for managing network services from multiple vendors

# Automation of site-manifests for an Open Stack under-cloud infrastructure

## CHALLENGE

The client was looking to develop an automation solution to generate site-manifests by extracting inputs from multiple sources that contain site specific details to drastically reduce the number of errors and the time required in generating manifests.

## SOLUTION

- Created the software design specification for the project names "spyglass".
- Development of plugins to extract site information from input sources such as excel files and rest-end points.
- Test and confirmation of generated site manifests on lab environments.

## TECHNOLOGIES LEVERAGED

OpenStack, Kubernetes, Python, YAML, OpenStack-Helm, REST

## VALUE DELIVERED

Standardized the interpretation of input data from various sources.

Significantly reduced the manual effort involved in creating site manifests.

Developed a solution that is easily adaptable to different templates.

One of the world's largest Telecom service providers aiming at 100% SDN transformation by 2020



# Virtualization of Roaming Network Functions

## CHALLENGE

The client who is a leader in roaming solutions for telecom service providers was on a journey to virtualize its solution. They were looking to achieve near line rate data path performance to make this transformation seamless and comparable to their existing PNFs. They also wanted to enable orchestration through Open Source Mano to comply with ETSI specifications besides developing a load balancer VNF application to filter and split Diameter and SCCP packets.

## SOLUTION

The solution developed by Happiest Minds included:

- Transport layer acceleration with OVS-DPDK.
- SR-IOV implementation for East-West as well as North-South for VNF traffic.
- Development of Load balancer and Traffic Segregation VNFs with session stickiness.
- Development of APIs as per ETSI specifications for OSM integration.
- Development of TOSCA/YANG model for VNF lifecycle management.
- Development of a load balancer VNF application to filter and split Diameter and SCCP traffic with session stickiness in a KVM/QEMU virtualized environment using PF RING ZC high speed packet capture library.
- It is an extensible solution designed to support any type of protocols in the future.

## TECHNOLOGIES LEVERAGED

C, C++, RHEL, OVS, RHOS, DPDK, SR-IOV, PF\_RING, OSM, YANG, TOSCA, PF\_RING ZC, KVM, QEMU, VirtIO, LibPCAP.

**A leader in  
roaming solutions  
for Telecom service  
providers**

### VALUE DELIVERED

Achieved virtualization of the roaming functions, with about 70% line rate.

Demonstrated interoperability with existing OSS/BSS solution and orchestration through OSM thus enabling hybrid deployments of legacy as well as virtual infrastructure.

Enabled a 5X performance gain for diameter and SCCP traffic.



# NFVi Engineering compliant to ETSI MANO Specifications

## CHALLENGE

The client wanted to implement a 'Cloud in a Box' NFV infrastructure compliant to ETSI NFV ISG MANO specifications with VNFs (vFW, vLTM, vSBC, vRouter) working together as a complete solution.

## SOLUTION

- Deployed OpenStack services (Compute, Network and Control) and Tacker on 3U chassis by configuring multiple hardware nodes running on an Intel XEON processor.
- VNF deployment creating YAML rules in Tacker, data path acceleration using DPDK followed by the creation of isolated and virtual test environments to fine tune VNF performance.
- Modification of OPNFV based CI environment (YardStick, Functest), taking care of automated deployment, performance testing and conformance testing of overall "Cloud In a Box" Solution.

## TECHNOLOGIES LEVERAGED

OpenStack, DPDK, JUJU, MAAS, Tacker, Yardstick, FuncTest

## VALUE DELIVERED

Standalone Platform infrastructure for multiple Telco use-cases and capable of future extensions (Openstack versions, new VNFs) which can be integrated and confirmed seamlessly.

**Leading Provider of  
Communications  
Modules and  
Systems**

# Reducing the Testing cycle duration from Days to Hours

## CHALLENGE

The client was losing precious time in their product development process as their current testing cycle was manual and required more than 20 days to complete. They were seeking to automate the testing process, reduce the debugging time on failure and create a CI and CT pipeline for more frequent releases with better code quality.

## SOLUTION

- Create a robust hybrid automation data driven and keyword enabled framework for rapid automation and enhanced reusability.
- Developed a concurrent test engine for simultaneous multi-product testing with minimal human intervention.
- Software Integration and enhancement of KLOV and Extent Reports to enable the generation of build and comparison reports.

## TECHNOLOGIES LEVERAGED

Selenium, JSCH, Jenkins, Extent Report, Klov, APACHE POI

**A Tier-1 North American OEM of Packet Monitoring Systems**

## VALUE DELIVERED

Created a robust and unified test framework that could cater to both developer and independent testing

Enhanced the reporting mechanism to enable the creation of executive level reports and technically detailed reports with historical comparison and trends for quality analysis.

Reduced the testing cycle from about 20 person days to less than a day with no manual effort.

## About Happiest Minds

Happiest Minds, the Mindful IT Company, applies agile methodologies to enable **digital transformation** for enterprises and technology providers by delivering seamless customer experience, business efficiency and actionable insights. We leverage a spectrum of disruptive technologies such as: **Big Data Analytics**, AI & Cognitive Computing, Internet of Things, Cloud, Security, SDN-NFV, RPA, Blockchain, etc. Positioned as "Born Digital . Born Agile", our capabilities spans across product engineering, digital business solutions, infrastructure management and security services. We deliver these services across industry sectors such as retail, consumer packaged goods, edutech, e-commerce, banking, insurance, hi-tech, engineering R&D, manufacturing, automotive and travel/transportation/hospitality.

Headquartered in Bangalore, India Happiest Minds has operations in USA, UK, The Netherlands, Australia and Middle East.

To know more about our offerings. Please write to us at  
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Born **Digital** . Born **Agile**

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