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**Linkedin : <https://www.linkedin.com/in/manip70/> github: SamPooni**

**SENIOR PRINCIPAL/ARCHITECT**

***Wireless, Data Center Networking & Storage***

***US citizen***

**PROFESSIONAL SUMMARY**

Accomplished Senior Principal / Technical Architect with 25+ years of demonstrated career success in developing and executing operational strategies to promote organizational growth and optimal utilization of emerging technologies in several areas of Wireless Networking including 5G, SDMN, Mobile Edge/IoT.

Participated and Delivered deep technical presentations at various industry forums including ONF Connect, IEEE 5G, SDN/NFV, ONS, Stanford university ONRC, various forums, and Telecom Council. Provided strategy, direction and technical leadership in developing and executing Research and Development Programs and lead the evolution of Next Generation Radio Access Edge (5G edge cloud) partnering with cutting edge startups, premier research institutions and professors and working with standard bodies with focus on producing new applications/software architectures for telecom.

Implemented several projects in the Storage domain including Container/Computational/ Cloud and Zoned Storage, NVMe, NVMe-oF, Key Value and Solid State Storage Solutions. I have participated in HP Standards representation (ANSI T11, SNIA , DMTF) and led standards implementations and in developing strategies for managing vendor/partner relationships.

Hands on Experience in designing and implementing **Microservices**, building Container Infrastructure (**Kubernetes/Docker-- Extending Kubernetes using CR, Automating Code Generation, Writing Custom Controller/Operator, Building Custom API servers**), automating CI/CD pipelines( gitops integration using **Spinnaker, Jenkins X and OpenShift**), implementing AI/Machine Learning/Deep Learning pipelines for Wireless using **Kubeflow**, NFV/ Edge Computing/Cloud Computing (Public, Private and Hybrid)/Security. Strong experience in building cloud native applications in **AWS, GCP and Microsoft Azure**. I have several years of development including Functional/ Object-Oriented/Aspect-Oriented Programming/Concurrent programming and Domain Driven Design, Functional Domain Models, Agile LightWeight Design and Evolutionary Architecture. Also have extensive experience in working on service mesh (Istio, AWS app mesh)

I have in-depth knowledge and exposure to different types of applications and architectures both ***Monolithic (multi-tiered, Pipelined, Microkernel)*** and ***Distributed (Service based, Event-driven, Space-based, Service-Oriented, Microservices).*** I also understand the tradeoff when it comes to Partitioning (Technical Vs Domain), Performance, Scalability, Reliability, Elasticity, etc.

* AWS –
	+ Very knowledgeable in Amazon Web Services Networking like **EC2** – compute (network interfaces), **VPC** – virtual networking (routing, security, NAT, DHCP, VPN), **ELB** – elastic load balancing, **Route53** – DNS, **DirectConnect** – hybrid cloud connectivity, **CloudFront** – content delivery network (CDN)
	+ Experience in AWS Configuration and Monitoring using **API-based configuration and monitoring**, Linux and PowerShell CLI commands, using **CloudFormation**: Amazon’s Infrastructure-as-Code language and other tools: **Ansible, Puppet, Chef, Terraform**.
	+ Very knowledgeable in AWS Regions/Availability Zones and in AWS network Security features like Security Group, Managed Prefix Lists, Network ACLs, **Microsegmentation,** VPC flow Logs, VPC traffic Mirroring, VPC Endpoint Policies, Web Application Firewall, AWS shield
	+ Very knowledgeable in AWS Internet Connectivity Internet Gateway, NAT Gateways and Instances and Ingress VPC Routing and External Connectivity using **AWS VPC - IPsec VPN** connections**, router-to-router VLAN** connections (Direct Connect), **inter-VPC peering**, and **Transit Gateways**
	+ Knowledgeable in AWS Network/Application Load Balancer, Global Accelerator
* Azure –
	+ Very knowledgeable in **Azure Geographies, Regions and Availability Zones**, High Availability and deployment models
	+ Very knowledgeable in Azure API, Azure Functions, VNet, Application Gateway, Azure DNS, Load Balancer, VPN gateway and Express Route.
	+ Experience in Azure Configuration and Monitoring using **API-based configuration and monitoring**, Linux and PowerShell CLI commands, using **Azure Resource Manager**: template-based deployment and management service and other tools: **Ansible, Puppet, Chef, Terraform**.
	+ Experience in **Azure Networking Core Elements** like Virtual Networks - Routing domains (VNet), subnets and route tables , Interfaces and IP addresses, Network services (DNS and DHCP), Network security , Internet access with NAT, VPN and ExpressRoute connectivity and Inter-region connectivity across Microsoft backbone
	+ Very knowledgable in **Azure Network Security mechani**sms like Network Security Groups, Application Security Groups, Packet capture and flow logging, Monitoring tools like IP Flow Verify.
	+ Very Knowledgeable in **Azure Virtual WAN**, Large-scale VPN/ExpressRoute deployments , Microsoft-managed WAN service , Hub-and-spoke connectivity between locations and Microsoft regions (hubs)
	+ Very knowledgeable in **Azure High Availability Solutions** like Availability sets , Storage replication , Network- or Application Load balancing within a region , DNS-based load balancing across regions

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|  | **MACHINE LEARNING DOMAIN** |
| **Data Science Tools**  | **Airflow**, Kubeflow, Luigi, TensorFlow, and MLflow  |
| **NN architecture** | CNNs, Segmentation Networks, NMT and Recommender Systems |
| **ML Libraries** | TensorFlow, Spark MLlib, Scikit-learn, PyTorch, MXNet, Keras, Caffe |
| **Learning as a Service** | Amazon, Microsoft Azure, Google Cloud AI, IBM Watson |
| **ML Compiler** | GPU, DSP architectures, LLVM, Machine Learning Compilers |
| **Mathematical operations and neural networking operators** | Linear Algebra, fast math libraries |
| **Python and frameworks** | Pandas, NumPy |
| **Big Data technologies** | Kafka, **Apache Spark 3.0**, **Apache Livy**, Apache Arrow, MapR, Hbase, Hive, HDFS Presto |
| **Machine Learning As a Service Platform (centralized)** | Machine Learning UI portal  | Jupyter Notebook UI/API, Data Management Design Studio, Feature Engineering Design Studio, Model Engineering Design Studio, Neural Network Studio/DSLs, Model deployment, OA&M |
| Machine Learning Services  | Expertise in Designing and building Data Ingestion Service, Training Service, Validation Service, Deployment Service, Repository - Service, Monitoring Service and Model Serving Services |
| Backend Services | Jupyter Hub/Server PODs design - Data Connector, Visualization, ML libraries, Anaconda, TensorFlow |
| Control Cluster Design -Istio Service Mesh, API, Runtime, ML framework, Data connector, Model Data |
| **Machine Learning****(Distributed)** | AutoML, HPO, Neural Architecture Search,Federated/distributed/decentralized ML for communication. |
| **Machine Learning****(Other areas)** | DSL + DSA(Risc-V) - compiler for ML, MLIR, Encoder/Decoder, GANs  |

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| APPLICATION DOMAIN |
| **Languages** | Scala (10 years) , Python (10 years), Java (20 years), Go (3 years), C/C++  |
| Functional/Reactive Programming Expertise – React, Vue, Javacript MetaProgramming |
| **Methodology** | Agile LightWeight Design (Versionone), Evolutionary Architecture, Domain Driver Design (DDD), Model Driven Automation (MDA), Extreme Programming ( XP), Test Driven Development(TDD),Scrum |
| **Microservice Framework** | Micronaut, Quarkus, Spring Boo, Vert.x,  |
| Distributed Configuration, Monitoring and Tracing  |
| **Message-Driven Microservices** | Kafka, RabbitMQ, Nats.io |
| **Service Mesh** | Istio, Linkerd, Consul |
| **Data Center Infrastructure** | Kubernetes (clustering, scheduling, controllers, API server, Service Brokers) Docker Networking, Mesos, Zookeeper, etcd, Consul |
| **GitOps** | Spinnaker, Argo CD, Jenkins X, Flux, OpenShift |
| **Cloud Platform** | Google Cloud Platform (GCP), Amazon Web Services Networking (AWS), Microsoft Azure Networking, Cloud Security, Virtual Firewalls |
| **Cloud Computing**  | Amazon - **Elastic Compute Cloud** (EC2), **Elastic Kubernetes Service** (EKS), **Elastic Beanstalk, Lambda, Fargate, Route 53**  |
| Google **- Compute Engine** (virtual machines), Google **Kubernetes engine** (managed Kubernetes cluster), **App Engine**(fully Managed Applications), **Cloud Functions** (serverless applications), **Cloud DNS** (managed DNS hosting) |
| **Cloud Deployment** | AWS Cloud Formation, Elastic Beanstalk and OpsWorks |
| Google Cloud Deployment Manager |
| **Cloud Storage** | AWS - **S3**, **Glacier**, EBS and instance store, **EFS** (sharing data volumes between machines), **Relational Database Service** (RDS), Amazon Elastic Cache, DynamoDB (noSQL),  |
| Google **- Cloud Storage**(Object Storage), **Nearline**, **Cloud Filestore** Managed File Store), **Cloud SQL** (Relational Storage), **Cloud Datastore** (Document Storage), **Cloud Spanner** (Large-scale SQL), **Cloud Big Table** (Large-scale structured Data) |
| **Cloud Machine learning** | Amazon - **Rekognition, Comprehend, Translate, SageMaker** |
| **Cloud Vision** (Image Recognition), **Cloud Natural Language** (Text analysis), Cloud Speech (Audio-to-text conversion) , Cloud Translation (Multi language Machine Translation) , Cloud Machine Learning Engine(Managed Machine Learning) |
| **Data processing and Analytics** | AWS – **RedShift, Pipeline, SNS, Kinesis** |
| Google **- BigQuery** (Data Warehouse), **Cloud Dataflow** (Large-scale data processing), **Cloud Pub/Sub** (Managed Event Publishing) |
| **IoT**  | **Device Level, Gateway, Platform Layer. Experienced in building Stack for *Constrained Devices* - Sensors and Actuators, Stack for *Gateways* - Connected and Smart Things, Stack for *IoT Cloud Platforms*** |
| **IoT Cloud Platform - *AWS IoT Platform*, Thingworx 8 IoT, Microsoft Azure IoT Suite, Google Cloud’s IoT, *Thingspeak IoT Platform*** |

**ROLES**

Founder of CSSQUAREDB TECHNOLOGIES (a Member of Facebook TIP)

Senior Principal Architect, Technical Lead for Wireless Software Competence Centre, Advanced R&D, Futurewei

Senior Principal Architect, Office of CTO, A10 Networks

Network and Storage Architect, Office of CTO, Virtustream (acquired by EMC )

Principal Architect, Dorado Software

Master Architect, Hewlett-Packard R&D Labs

**EDUCATION**

Masters in Information Systems Engineering, [Manipal Institute of Technology](https://manipal.edu/mit.html), Mangalore University

Bachelors in Computer Science Engineering, [Sri Venkateswara College Of Engineering](https://en.wikipedia.org/wiki/Sri_Venkateswara_College_of_Engineering), Madras University

**COURSES**

**Functional programming in Scala** by John De Goes

**The Art of Functional Design** by John de Goes

**Write a Compiler (in Python**) by David Beazley

**Structure and Interpretation of Computer Programs** by David Beazley

**Implementing a Raft Consensus Algorithm** by David Beazley

**Advanced Programming with Python** by David Beazley

**QUALIFICATIONS HIGHLIGHT**

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| Lead Product Designs, POC & ROITrack Industry trends, Drive Roadmaps, Investment & TTM.Represent Industry Forums and Technical Conferences | University Research partnership and Startup ideas.Coach, Mentor and Drive organizational innovation.R&D and full development lifecycle |

**DOMAIN KNOWLEDGE**

**TELECOM**

* Responsible for the designing the blue print for the cloud RAN architecture at Futurewei setting the direction for wireless in terms of 5G Radio and subsystems architecture, implementation and ecosystem.
* Expertise in RAN disaggregation into microservices, virtualization of services using CAAS built over kubernetes and automating the devops pipeline.
* Expertise is building MobileEdge/IoT services using GCP
* Expertise in the LTE/5G eNodeB/gNodeB and the associated software development Life Cycle that goes with it. Involved in the 3GPP specifications related to functional splits (CU/DU/RRU architecture), network slicing.
* Expertise in SDN/NFV & radio optimization, application optimizations, architecture, advanced LTE, 5G, applications aware networking, traffic management, optimization, self-organizing networks, and cross layer optimization designs.
* Expertise in Virtualization of network resources and use case practices toward 5G deployments, including applications, IOT devices, for and standards and development of best architecture practice.
* Lead Development of Reference platform for mobile applications.
* SDN development and virtualization studies using cross layer design techniques for V-RAN/X-RAN
* Deep understanding of the X-RAN and later the O-RAN specification, Facebook TIP/OpenRAN projects, ONF MCORD/SD-RAN.
* Very good experience in ONAP, ACUMOS and AKRAINO part of the Linux foundation.

**MACHINE LEARNING**

* I have very good experience in machine learning where I have architected a High Performant Reactive Developer centric MLaas Platform for wireless, automating the entire ML pipeline end-to-end. I have also worked on Federated/distributed/decentralized ML, AutoML and NAS.
* I have excellant experirence in Big Data Technologies like Spark, Hadoop, M/R, HDFS, Pig, Hive, Presto.

**DATACENTER NETWORKING**

* I have more than 10 years experience in the Data Center Space. I have very good knowledge in Data Center Fabric Architectures, in building Data Center Infrastructure for Networking, Data Center Interconnects, Designing Active-Active and Disaster Recovery Data Centers, Hyper-Converged Infrastructure, Leaf-and-Spine Fabric Architectures etc.
* In the Networking Space, I have extensive experience in, Network Virtualization, Network Security, Overlay Virtual Networks and Scaling, Private Virtual Networks, Containers and Docker Networking

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|  |  **NETWORK DOMAIN** |
| **Data Center Infrastructure** | Kubernetes, Docker Networking, Security and Devops in Enterprises |
| **Software-Defined Data Centers (SDDC)** | Cisco ACI, VMware NSX |
| **Network Virtualization** | Virtual Firewalls, vSphere 6 Networking Deep Dive, VXLAN Technical Deep Dive |
| **Network Orchestration** | ODL, OpenStack  |
| Network Domain Modeling, Network Virtualization, Building autonomous networks with dynamic service insertion, service chaining and composition capabilities using programmable flows |
| **Software Defined Networking (SDN)** | SDN Architectures/ Deployment. NFV, Monitoring, UseCases, BGP-Based SDN solutions, PCEP and BGP-LS, SD-WAN  |
| Software defined Mobile Controller Design (SDMN) |
| SDN/NFV MANO architecture |
| Programmable Hardware, P4, Openflow, OVS, Overlays (Vxlan), BGP-Based SDN Solutions |
| **Cloud Computing and Networking** | Networking Public clouds | Amazon Web Services Networking, Microsoft Azure Networking, Cloud Security, Virtual Firewalls |
| Networking Private clouds | Scaling Overlay Virtual Networks, VXLAN, Data Centre Fabric Architectures, Leaf-and-Spine Architectures |
| **Data Centre Fabrics** | Data Center Fabric Architectures, Data Center Infrastructure for Networking, Data Center Interconnects, Designing Active-Active and Disaster Recovery Data Centers, Hyper-Converged Infrastructure, Leaf-and-Spine Fabric Architectures . |
| **Virtual Private Networks** | DMVPN, Ethernet MPLS/VPN |
| **5G/RAN/OPENSOURCE** | MCORD/ONOS, ORAN-SC, ECOMP/ONAP, ACUMOS-AI, AKRAINO, OAI, TOSCA, HELM CHARTS |
| **Network Protocols/Services** | L1-L3 | Expertise in Building Studio based workflow for designing network services and provision them on the fly.* Topology Discovery/Link Discovery based on Domain Driven Design.
* Manage L2/L3 network services across heterogeneous devices for various vendors
 |
| L4 | Networking Protocols - TCP/IP Protocol, Routing protocols like BGP, OSPF, EIGRP, IS-IS and RIP |
| L4-L7 | Expertise in building LBAAS, FWAAS |
| Strong expertise in Building Load Balancing Services, Firewall Policies and VPN gateways |

PROFESSIONAL EXPERIENCE

**CSSQUAREDB TECHNOLOGIES Oct 2019 – Present**

**Founder**

I founded a company after I left Futurewei in November of 2019, which specializes in the area of private LTE networks. My company CSSQUAREDB TECHNOLOGIES is a member of the Facebook TIP and participates in the following open source projects:

* Edge Application Developer
* End-to-End Network Slicing (E2E-NS)
* Open Core Network
* OpenRAN
* OpenRAN 5G NR
* Wireless Backhaul

Projects:

Designed, executed and optimized a number of open source/client projects in Machine Learning. The most significant projects among them are:

* Developed a high performant Parameter Server in python for Scaling Distributed Machine Learning in Python over GCP.
* Implementing a MLIR compiler in python to generate Web Assembly code to allow AI in browser for very fast edge based ML inference.
* Development of a Functional Library in Scala called Zio-Prelude to facilitate build ML pipelines. The cloud development was done using AWS

**FUTUREWEI TECHNOLOGIES, ADVANCED R&D Mar 2016 – Sep 2019**

**Wireless Software Competence Centre (WSCC)**

**Senior Principal Architect**

As Principal Architect for Software Architecture at WSCC I worked in the area of Software Defined Mobile Networks (SDMN) where I was responsible for spear heading cutting edge R&D efforts and bringing thought leadership into architecting and building a low latency, next generation highly distributed and scalable, mobility platform for 5G, IOT, MEC and beyond

Responsibilities:

* Identify new software Architecture/technological trends in the 5G, IOT, MEC and Machine Learning/deep learning spaces through market research/conferences
* Provide market analysis to senior leadership on their impact on the wireless as a whole and to Futurewei in particular.
* Come up with an engineering plan/charter to explore and productize new applications/software architectures for the top 3-4 items for each year in terms of ROI, TTM and retaining market leadership
* On acceptance from senior management build a project proposal in terms of university engagement, partnering with startups, manpower, measurable goals and delivery timelines.
* At the end of the year produce a report and post mortem analysis to senior management.

Contributions:

RAN disaggregation/virtualization and CUPS segregation

* Expertise is building Mobile Edge/IoT services using GCP
* Developed a blueprint for cloud RAN architecture which was adopted unanimously by senior leadership in china
* Built a Disaggregated, Distributed RAN/Core and end-user services allowing dynamic, automated, policy-driven programmatic control of the RAN where
* The disaggregation into microservices had less than 2% degradation in performance.
* Virtualization - The containerized components running on COTS servers/white box switches were orchestrated using a container as service (Kubernetes) solution which eased deployment significantly.
* The end-to-end automation of the development pipeline brought down the development time from months to week
* We used AWS and GCP Cloud deployments for building some of the PoCs. Extensively used Service Mesh for deployments.
* Build a Software Defined Mobile Controller which could orchestrate the central office rearchitected as a datacenter and the edge cloud and in particular the disaggregated RAN.
* This involved partnering with professor Dr. Ian F. Akyildiz from Georgia Institute of Technology and his research team to build a Mobile Controller.
* Built on RAN Disaggregation and CORE CUPS Disaggregation
* Built a cloud-native distributed mobile Edge cloud platform which would enable telecom vendors/service providers to monetize by providing edge cloud services.
* This involved developing a highly distributed and reactive function-as-a-service (FAAS) middleware platform to host latency sensitive services where a number of reactive architectures was prototyped by engaging with a number of startups.
* The RAN disaggregation involved separating the functionality into RU and DU which are distributed and CU which is centralized and doing a CUPS disaggregation.
* The Core CUPS disaggregation was done resulting in UPF and disaggregated core control plane functions.
* This was followed by an integration with Programmatic Access which was achieved using the SDMN controller
* A P4-based user plane was built using white box switches.
* Finally E2E network slicing support was added.
* Bring in the notions of immutable devops to the development pipeline

Wireless Big Data and Analytics

I was leading the effort at our Data Access lab in china with one of our largest customers in china having

* 1.65 Million 4G base stations (about 32% of Global LTE base stations).
* The biggest 100G network with a system bandwidth of 81.4T of data.
* From the Data Center perspective they produce 14K TB/day, 4 Group DC’s with backup and 63 DCs in 31 provinces in china
* They had 800M+ Connections in 2020

The data in mobile cellular networks, such as CDRs, GPS data, web clickstream and logs were used to process:

* *Big Signaling Data*
* *Big Traffic Data*
* *Big Location Data*
* *Big Radio Waveforms Data*

We used Apache Spark and pandas. Some of the big data applications developed were

* Big Data based Local Content Provisioning
* Big Data based Flexible Deployment and Functionality
* Customized Mobility Management & Simplified Signaling
* Big Data Assisted Beam Sweeping & MIMO Transmission,
* Big Data based User Behavior awareness,
* Big Data based Network Operation and Maintenance for Coverage Enhancement and Problem Detection
* Big Data based Network Energy Saving.

We used *Hive* for high volume data processing. We ran *spark* jobs on yarn cluster. We used *spark SQL, PySparkSQL and Pandas* for building SQL queries to retrieve data and the results were pushed to *Hbase* for quick access.

Also some of the PoCs in the US were implemented over *AWS and Google cloud platforms.*

Machine Learning as a Service

* Researched and prototyped a High Performant Reactive Developer centric MLaas Platform for wireless, automating the entire ML pipeline end-to-end. This was to add intelligence to the RAN/SDMN controller and Wireless Applications. This involved building a **Machine Learning portal, Machine Learning Services , Backend Services. (**Built ML pipelines using service mesh**)**

**A10 NETWORKS, OFFICE OF THE CTO Mar 2012 – Jan 2016**

**Senior Principal Architect**

Project Details:

As Senior Principal Architect, reporting to the CTO and responsible for providing technical leadership for delivery of Cloud Networking, SDN and Data Center Management Solutions. Responsible for Cloud, SDN , NFV and Data Center Management Solutions, driving Platform, SDN, NFV, Cloud and Flexible licensing strategy. Also hold ownership for the overall management platform for Device management, ADC and DDoS.

- SDN - Cisco UCSD, Cisco ACI, VMware NSX integration and Nuage.

- aGalaxy Centralized management for ADC, Threat protection(DDoS) and Security.

- A10 Virtualized appliances and Hardware accelerated Virtual Appliances (HVA)

- A10 Cloud editions (AWS, Azure)

- NFV integrations with HP, Overture, Anuta, Ericsson etc.

- Industry 1st Pay-as-you go SaaS based Billing and Lifecycle management

Contribution:

* Single Handedly auto-generated the entire REST SDK for various language bindings like Python and Scala from JSON/Proprietary schema. The SDK had self-documenting capabilities where I used sphinx in python and swagger in Scala to generate the documentation. Even the wire-specs were auto-generated.
* I did dynamic auto-generation of SNMP MIBs/data-driven SNMP subagent, YANG/YIN modules from JSON schemas.
* Expertise in development of JSON to UML and UML to JSON eclipse MDL plugins to provide a developer studio with drag and drop capability to support modeling and auto-generation of SDK for REST/SNMP/YANG etc.
* Expertise in building Multi Device Load balancing services (scaling of advanced Load balancing services).
* Building of Service Manager and Service Insertion capabilities along with building of programmable overlays like VXLAN from a central orchestrator
* Experience in development of Load balancing services within cisco UCSD/ACI and in VMware NSX framework (Workflow/Task development in-addition to Resource discovery)
* Expertise in writing TPS mitigation plugins in ODL and development of Advanced Load balancing services in OpenStack.
* Expertise in building AMQP based subscription mechanisms within the devices to form a peer-to-peer network and to help in auto-scaling of the load balancing and server tiers.

**VIRTUSTREAM, R&D Aug 2011 – Mar 2012**

**Principal Architect Storage and Networking**

I was part of the leadership team at Virtustream holding the position of ***Principal Architect***, reporting to the Executive Vice President of Engineering. I was responsible for the development of Storage/Networking software used to manage Virtustream Data centers called Xstream.

Contribution:

As a Lead Architect, I owned the entire Storage and Networking Software Portfolio and I was the SDN orchestration lead who was responsible for establishing partnership with various leading SDN vendors in the market alongside marketing and integrating it into Xstream for orchestration.

**DORADO SOFTWARE, R&D Nov 2007 – Aug 2011**

**Principal Architect Storage and Systems**

I was part of the leadership team at ***Dorado Software Inc., Folsom***, holding the position of ***Principal Architect***, reporting to the Director of Software development, where I was responsible for setting the direction for the company as a whole, on the development of Storage, Network and Server Management software which can allow the Next Generation Data Center Management [Virtual Resource Infrastructure Management].

Projects:

* Redcell Virtual Resource Infrastructure Management - Service Orchestration for Virtual Data Centers
* Redcell Campus Manager - Manages L2/L3 network services across heterogeneous devices for various vendors. It provides complete Link Discovery, VLAN and Trunking Protocol (VTP/GVRP) management, Spanning-tree management and visualization, Path analysis, VRF and MPLS/VPN management etc.
* **Redcell Storage Commander** - Single console management product for managing multi-vendor SAN infrastructure devices

Contribution:

* I lead a team of Domain experts in Policy Based Adaptive Distributed Load Balancing based on Live Migration of Virtual Machines and Physical/Virtual network reconfiguration across heterogeneous hypervisors (VMware/Hyper-V).
* I was the Lead Architect on the Redcell Campus Manager targeted towards the SMB and Enterprise market.
* I was the Lead Software Architect on the Development of Storage Services and Simplifying Storage Provisioning through Workflow

**HEWLETT-PACKARD LABS Jul 1997 – Nov 2007**

**Procurve Networking R&D, SWD R&D LABS**

**Software Design Engineering Lead**

**As a Lead Architect, part of Network Security Group of Procurve, Roseville,** I worked on the development of a Network Security Blade for the Procurve Switches which has an integrated VPN, Firewall, IPS/IDS functionality. I also worked on the Routing and High availability/clustering portions of the product, leading a Team of Engineers in Mexico/India. I worked at the ***Storage Software R&D Labs (SWD) and Procurve Networking R&D Labs at Hewlett-Packard, Roseville*** for more than 10 years as a Master Architect (SWE) where I Lead projects in Networking/Storage. I have been involved in all the storage standards right from its inception ranging from SCSI, FC, iSCSI[TOE], iSER, INFINIBAND, iWARP, Converged Lossless Ethernet/DCBX, FCOE, ROCE, 10G Ethernet/SR-IOV and their respective implementations in Hardware and Software by the various vendors.

Projects:

* Development of integrated VPN/Firewall/IPS/IDS blade with clustering and HA support which could be plugged into procurve switches.
* Greyhound Infrastructure Management Project for the HP PRONAC-800 Network Security Appliance.
* Lead teams in the ILM space like **Disk to Disk (D2D)** Archival/Retention, building enterprise class applications in SRM space like **Open View Storage Area Manager (OV-SAM)** and  **HP Systems Insight Manager (HP-SIM)**

Contribution:

* As a Lead Architect, part of Network Security Group of Procurve, I worked on the development of a Network Security Blade for the Procurve Switches which has an integrated VPN, Firewall, IPS/IDS functionality.
* I also worked on the Routing and High availability/clustering portions of the product, leading a Team of Engineers in Mexico/India. The complete stack was written in Linux 2.6. I worked mainly on integrating the software with a hardware based load balancer which can bring statelessness into the Echelon IPS/IDS detection engine.
* I also worked on the Greyhound Infrastructure Management Project for the HP PRONAC-800 Network Security Appliance. The work involved
* Customizing and hardening the Linux 2.6,
* Creating the Control/Application Partition Layout
* Development of a generic mechanism for Firmware Updates
* Development of Manufacturing Diagnostics
* Creating BIOS Specific Extensions
* Writing Flash drivers to program Manufacturing /App specific information in the PROM
* Writing LCD drivers to provide a facility for applications to generate alerts, system error messages during boot
* Backup/Recovery of the applications etc.

**IBM [Formerly SEQUENT COMPUTERS INC] Mar 1994 – Jun 1997 Software Engineer**

Projects:

DYNIX/PTX OS Project- The DYNIX/PTX OS project involves the Development and Maintenance of DYNIX/PTX Symmetric Multiprocessing (SMP) UNIX and the NUMA versions running on SEQUENT machines.

Contribution:

I was part of BASE OS team of SEQUENT COMPUTERS INC. BEAVERTON, USA. and I have worked on multiple versions of DYNIX/PTX.

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| APPLICATION DOMAIN |
| **Languages** | Scala, Python, java, C/C++ |
| **Tools/IDE** | Maven, Sbt, Gradle, IntelliJ, Pycharm, Eclipse |
| * **Functional Programming Expertise**
 | Function Composition, ADT, Higher-Kinded Types and Type Classes |
| Functor Hierarchy, Folds and Optics [Monoids, Functors, Monads, Lenses, Prisms, and traversals] |
| Functional Effects, Functional Domain Models |
| **Reactive Programming Expertise** | RxJava 3, Reactor - reactive domain models, Modeling with reactive streams, Reactive persistence and Event sourcing |
| **Compiler experience** | Data modeling (involving ASTs), Parsing, Interpretation, Type checking, Control-flow analysis, Code generation and Native code generation (LLVM and WebAssembly) |
| **Methodology** | Agile LightWeight Design, Evolutionary Architecture, Domain Driver Design (DDD), Model Driven Automation (MDA), Extreme Programming ( XP), Test Driven Development(TDD), Scrum |
| **Microservice Framework** | Micronaut, Quarkus, Lagom, Spring Boot,. Eclipse Vert.x, Axon.IQ |
| **Service Mesh** | Istio, Linkerd, Consul |
| **Distributed Systems Runtime** | Akka |
| **Distributed Configuration** | HashiCorp Consul/vault, Spring cloud config, AWS Parameter Store, Oracle Cloud Vault |
| **Service Discovery**  | Consul, etcd, Zookeeper, Eureka, Kubernetes, AWS Route 53 |
| **Client Side Load Balancing** | Netflix Ribbon, Amazon ELB |
| **Distributed Tracing** | Zipkin, Jaeger, Datadog |
| **Distributed Monitoring**  | Prometheus, Grafana, graphite, statsD |
| **API design**  | gRPC, OpenAPI, REST, GraphQL, WebHooks |
| **Serialization Frameworks** | Google Protocol Buffers, Apache Thrift |
| **Serverless Functions** | AWS lambda, Google Cloud Function, Google Cloud Run, Azure Function |
| **Message-Driven Microservices** | Kafka, RabbitMQ, Nats.io |
| **NoSQL Databases** | Cassandra, HBase, MongoDB, Riak, DynamoDB |
| **In-memory databases**  | Apache Arrow, Redis |
| **Columnar databases**  | mariaDB, HBase, Apache Parquet, MonetDB |
| **Time-series databases** | InfluxDB, DataStax, FaunaDB |
| **Message Brokers** | Kafka, Pulsar |
| **Infrastructure** | Kubernetes, Mesos, Zookeeper, etcd, Consul |
| **In Memory Data/Compute Grids** | Hazlecast, Pivotal Gemfire |
| **Distributed Stream Processing Engines** | Samza, Flink, Spark, Storm, kafka |
| **Steaming Data Pipelines** | CloudFlow |
| **File Systems**  | HDFS, Ceph, GlusterFS |
| **GitOps** | Spinnaker, Argo CD, Jenkins X, Flux, OpenShift |

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| **SYSTEMS DESIGN** |
| **Parallel and High Performance Computing** | Parallel algorithms and patterns, Vectorization, OpenMP, MPI |
| GPU architecture/programming Model, Directive-based GPU programming, GPU languages, GPU profiling |
| Affinity, Schedulers, parallel input/output |
| **Dataflow and reactive programming systems** | Dataflow, Actor Model, Flow-based programming, Communicating Sequential Processes, Implicit dataflow, Asynchronous/Synchronous and dynamic dataflow Implementation |
| TPL dataflow |
| Dataflow Program Design |
| **Operating Systems** | Linux Kernel/Driver development/Filter Driver Experience |
| Embedded System Experience - System-on-Chip (SoC) firmware, BIOS and Embedded Linux. |
| HP-UX Driver Development Experience, VxWorks Development Experience |
| **Virtualization** | KVM, VMware NSX and Hyper-V and virtual switches |
| **Containerization** | Docker, Kubernetes, Mesos |

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| STORAGE ExPERTISE |
| **Storage** | Cloud Storage | SDS Architectures for Agility, Architecting Storage Application for the Public Cloud Economy, decentralized cloud |
| Computational | Computational Storage Solutions, SmartNICs and SmartSSDs for Smart Acceleration, Transparent Compression, Deep Compression for All-Flash Array, Computational Storage at the Edge, Data-Centric Storage Architectures |
| Container | SPDK-CSI(SPDK/Kubernetes Storage), CSI plugins for kubernetes, Dynamic Storage Provisioning in Kubernetes of Persistent Volume (PV) and PV Claim (PVC) |
| **Solid State Storage** | NVMe, NVMe-oF, Key Value and Solid State Storage Solutions |
| **Storage Orchestration** | Software Defined Storage, Storage Resource Management and Storage Virtualization |
| **Storage Chip Abstraction Layers** | Expertise in building Storage Interface/Device Drivers (Initiator/Target mode) for Tachyon, Tachlite and QLA-2200 family of Fibre-Controllers. Expertise in building * Chip abstraction layers
* FC Layer Abstractions (FC-2/FC-4) and
* OS Independent Layers
 |
| Expertise in building firmware diagnostics for various Fibre controller chips as part of the bring up |
| Development of Target Mode drivers for Target Emulation(Disk/Raid emulation)/ Fault injection. |
| **Storage****Protocols/drivers** | Storage Protocols - SCSI, Fibre-Channel, iSCSI[TOE], iSER, FCOE, Infiniband, iWarp, ROCE. | Architecting various points in the storage stack * Shim layer drivers using protocol assists (I/T functionality)
* Controller/OS independent Layers
* Bus/HBA/Filter/Disk/multipath/fault-tolerant drivers

 RAID Software (I/T) |