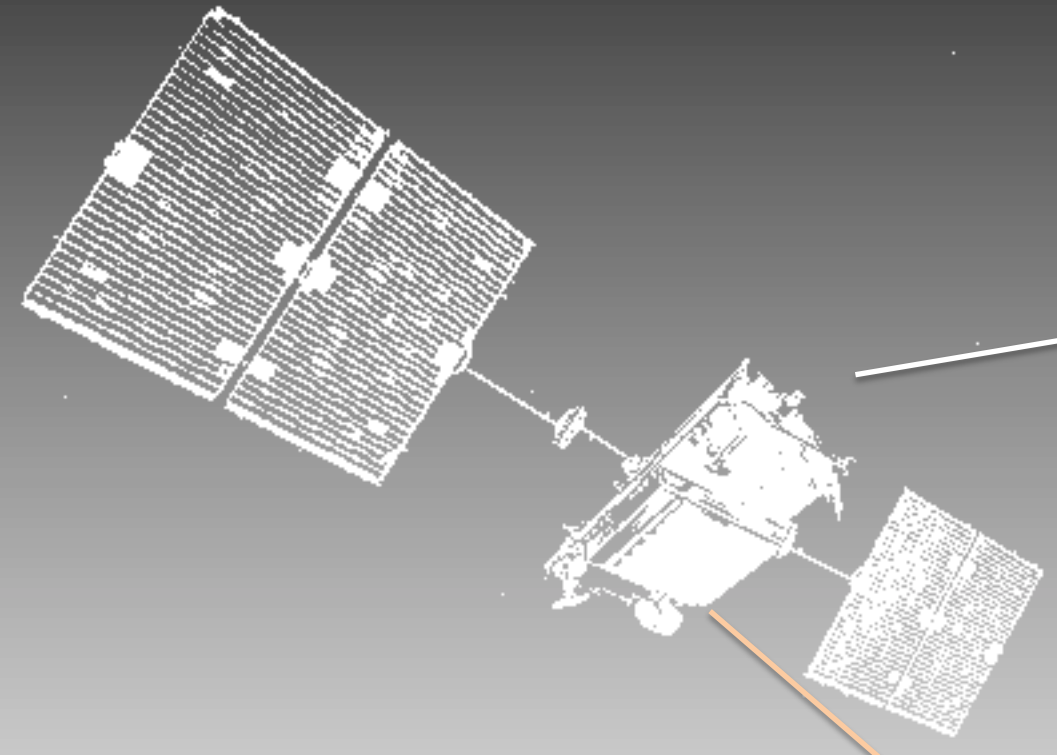
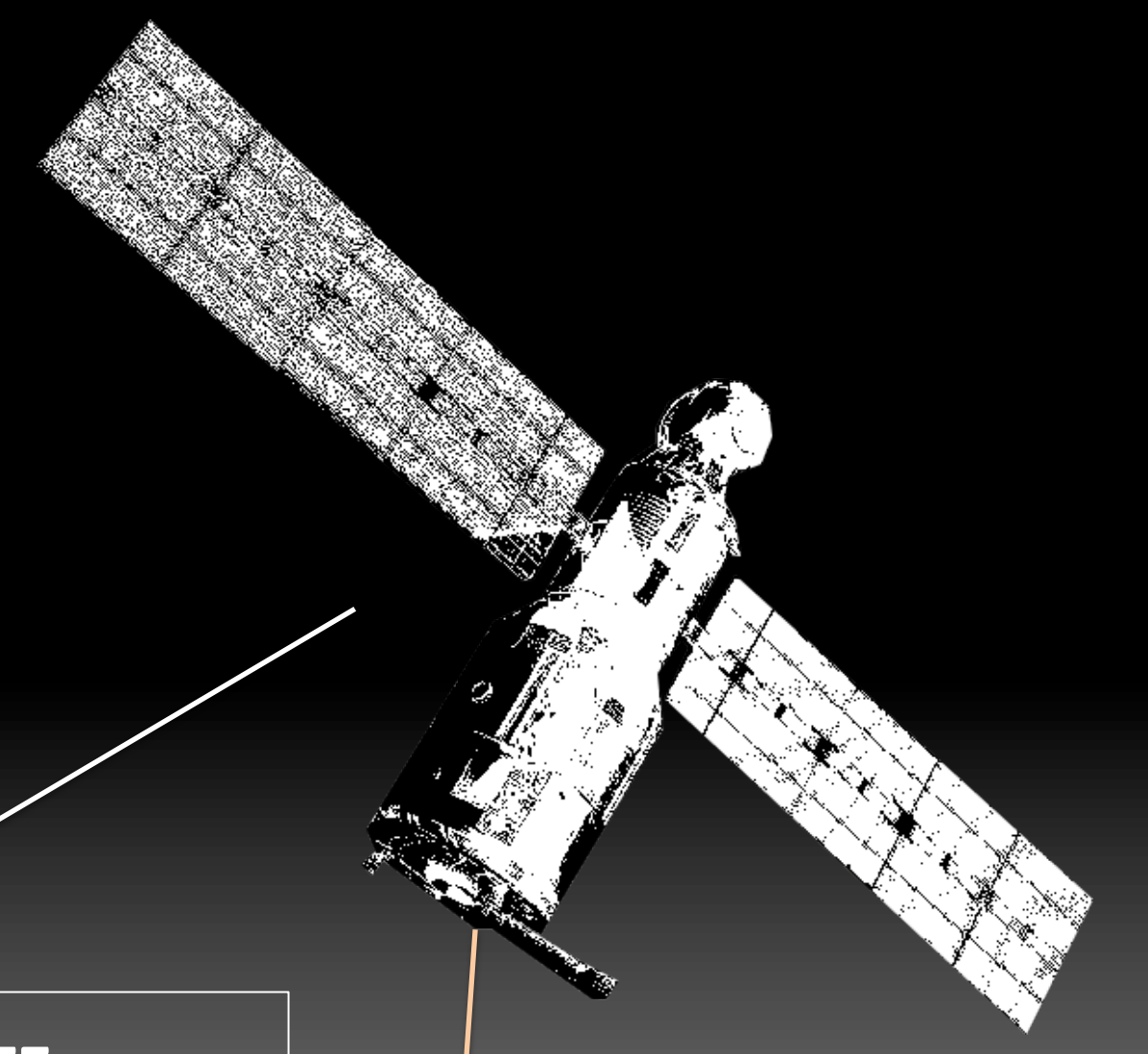


Deployment of smart complex system optimizing transmission bandwidth from offshore to open seas



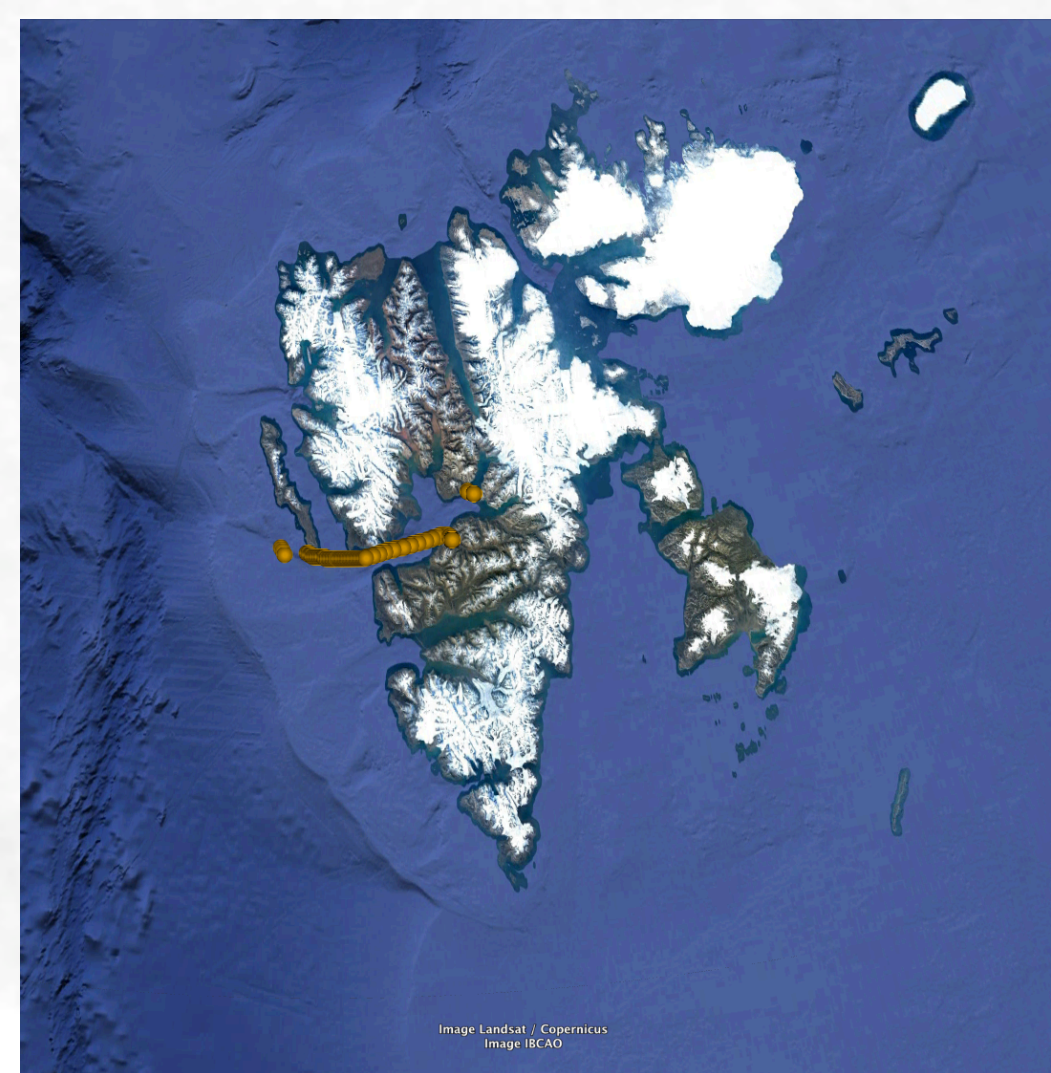
Marcin Wichorowski *wichor@iopan.pl*
Krzysztof Rutkowski *kr@iopan.pl*
 Institute of Oceanography Polish Academy of Sciences



LOW EARTH ORBIT SATELLITE
 BANDWIDTH: LOW
 LATENCY: AVERAGE
 COST: HIGH

GEOSTATIONARY SATELLITE
 BANDWIDTH: LOW
 LATENCY: HIGH
 COST: AVERAGE

LTE
 BANDWIDTH: HIGH
 LATENCY: LOW
 COST: LOW



LTE range at Svalbard is available in the region of Longyearbyen (Isfjorden) and extends to the southern part of the Prince Charles Foreland, geostationary is not available



- **Multiple ISP providers for ship:** LTE (low cost, high speed 3G/4G), SAT (KVH 128 kbps unlimited, 10 Mbps limited data), LEO (IRIDIUM 128 kbps limited data)
- **Smart multi-gateways routing:** default gateway switching based on latency thresholds
- **DNSBL feeds for firewall on ship for blocking of unwanted data:** Windows updates/telemetry, antivirus updates, social media, Dropbox, internet radio/movies/video streams

Status / Dashboard

System Information	Interfaces																												
Name: oceania-gateway.oceania.iopan.pl System: pfSense Netgate Device ID: cad132fca00a6e62d67 BIOS: Vendor: Xen Version: 4.7.1-1.2 Release Date: Thu Feb 16 2017 Version: 2.4.3-RELEASE-p1 (amd64) built on Thu May 10 15:02:52 CDT 2018 FreeBSD 11.1-RELEASE-p10 Obtaining update status CPU Type: Intel(R) Xeon(R) CPU D-1518 @ 2.20GHz 4 CPU(s): 4 package(s) x 1 core(s) AES-NI CPU Crypto: Yes (active) Hardware crypto: AES-CBC/AES-XTS/AES-GCM/AES-ICM Kernel PTI: Enabled Uptime: 17 Days 21 Hours 59 Minutes 08 Seconds Current date/time: Fri Nov 2 8:34:44 GMT 2018 DNS server(s): • 192.168.1.15 • 10.19.130.229 • 8.8.8.8 • 8.8.4.4 • 10.20.20.40 Last config change: Fri Nov 2 7:55:45 GMT 2018 State table size: 0% (162/814000) Show states MBUF Usage: 0% (1526/507708) Load average: 0.08, 0.19, 0.22	Interfaces: WAN1_JSP1_LTE manual 192.168.100.245 LAN manual 192.168.1.1 WAN2_JSP2_SAT_IRIDIUM manual 192.168.90.1 WAN3_JSP2_SAT_KVH manual 192.168.5.245 WAN4_PUBLIC_IP_SAT_KVH manual 172.25.101.18 pfBlockerNG: MaxMem: Last Modified: Wed, 26 Sep 2018 16:41:01 GMT Permit 3 DNSBL791270 <table border="1"> <thead> <tr> <th>Alias</th> <th>Count</th> <th>Packets</th> <th>Updated</th> </tr> </thead> <tbody> <tr> <td>pfDNSBLIP</td> <td>110834</td> <td>10</td> <td>Oct 25 12:30</td> </tr> <tr> <td>pf_oceania_whitelist_precy</td> <td>3</td> <td>669</td> <td>Oct 27 12:30</td> </tr> <tr> <td>DNSBL_shalleist2pfBlockerNG</td> <td>812010</td> <td>3034588</td> <td>Sep 23 09:36:04</td> </tr> <tr> <td>DNSBL_Windows_telemetry</td> <td>82</td> <td>1590888</td> <td>Sep 23 09:36:04</td> </tr> <tr> <td>DNSBL_japan_deny_sites</td> <td>7</td> <td>1748</td> <td>Sep 23 09:36:04</td> </tr> <tr> <td>DNSBL_windows_update</td> <td>26</td> <td>45566</td> <td>Sep 23 09:36:04</td> </tr> </tbody> </table>	Alias	Count	Packets	Updated	pfDNSBLIP	110834	10	Oct 25 12:30	pf_oceania_whitelist_precy	3	669	Oct 27 12:30	DNSBL_shalleist2pfBlockerNG	812010	3034588	Sep 23 09:36:04	DNSBL_Windows_telemetry	82	1590888	Sep 23 09:36:04	DNSBL_japan_deny_sites	7	1748	Sep 23 09:36:04	DNSBL_windows_update	26	45566	Sep 23 09:36:04
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Status / Gateways / Gateways

Name	Gateway	Monitor	RTT	RTTsd	Loss	Status	Description
WAN1_LTE_DUALSIM_GW	192.168.100.1	8.8.8.8	107.778ms	38.547ms	0.0%	Online	LTE Dual-SIM gateway, default
WAN2_JSP2_SAT_IRIDIUM_GW	192.168.90.90	10.20.20.40	0ms	0ms	100%	Offline (forced)	satellarny gateway, iridium
WAN3_JSP2_SAT_KVH_GW	192.168.5.1	208.67.222.222	712.381ms	63.195ms	0.0%	Online	satellarna brama KVH 128 kbps nielimitowana

Firewall / NAT / Outbound

Name	Outbound NAT Rule	Description	Outbound NAT Rule	Outbound NAT Rule	Outbound NAT Rule
WAN1_LTE_OUTBOUND	WAN1_LTE_OUTBOUND	WAN1_LTE_OUTBOUND	WAN1_LTE_OUTBOUND	WAN1_LTE_OUTBOUND	WAN1_LTE_OUTBOUND
WAN2_JSP2_SAT_OUTBOUND	WAN2_JSP2_SAT_OUTBOUND	WAN2_JSP2_SAT_OUTBOUND	WAN2_JSP2_SAT_OUTBOUND	WAN2_JSP2_SAT_OUTBOUND	WAN2_JSP2_SAT_OUTBOUND
WAN3_JSP2_SAT_OUTBOUND	WAN3_JSP2_SAT_OUTBOUND	WAN3_JSP2_SAT_OUTBOUND	WAN3_JSP2_SAT_OUTBOUND	WAN3_JSP2_SAT_OUTBOUND	WAN3_JSP2_SAT_OUTBOUND

Firewall / pfBlockerNG / Edit / DNSBL Feeds

General Update Alerts Reputation IPv4 IPv6 DNSBL GeoIP Logs Sync

DNSBL DNSBL Feeds DNSBL EasyList

LINKS Firewall Alias Firewall Rules Firewall Logs

DNS GROUP Name: shallalist2pfBlockerNG

Description: shallalist to pfBlockerNG

DNSBL Settings

DNSBL	Auto	ON	/tmp/BL/adv/domains
	Auto	ON	/tmp/BL/aggressive/domains
	Auto	OFF	/tmp/BL/alcchol/domains
	Auto	ON	/tmp/BL/anomprn/domains
	Auto	OFF	/tmp/BL/automobile/boats/domains
	Auto	OFF	/tmp/BL/automobile/cars/domains
	Auto	OFF	/tmp/BL/automobile/planes/domains
	Auto	OFF	/tmp/BL/chat/domains
	Auto	OFF	/tmp/BL/costtraps/domains

References

- IMO MSC 81/23/10 Development of an E-Navigation strategy.
- Report from 12th session – COMSAR (Sub-Committee on Radiocommunications, Search and Rescue), IMO, Londyn 2008.
- Bronk K., Lipka A., Niski R., Waraksa M., Wojnicz P., Żurek J., Analiza pomiarów jakości i dostępności sieci komórkowych na morzu (Przeгляд Telekomunikacyjny i Wiadomości Telekomunikacyjne) SIGMA NOT 2012 nr 4 s.412-415 CD-ROM
- Garroppo, R.G.; Giordano, S.; Iacono, D.; Cignoni, A.; Falzarano, M., "WiMAX testbed for interconnection of mobile navy units in operational scenarios," Military Communications Conference, 2008. MILCOM 2008. IEEE, vol., no., pp.1-7, 16-19 Nov. 2008
- Garroppo, R.G.; Giordano, S.; et al., "Experimental analysis of a WiMAX-satellite network for emergency management in sea areas," World of Wireless, Mobile and Multimedia Networks & Workshops, 2009. WoWMoM 2009. IEEE International Symposium on a, vol., no., pp.1-6, 15-19 June 2009
- Kdouh, H.; Brousseau, C.; Zaharia, et al., "Measurements and path loss models for shipboard environments at 2.4 GHz," Microwave Conference (EuMC), 2011 pp.408-411, 10-13 Oct. 2011
- Kun Yang; Roste, T.; Bekkadal, F.; Husby, K.; Trandum, O., "Long-Distance Propagation Measurements of Mobile Radio Channel over Sea at 2 GHz," Vehicular Technology Conference (VTC Fall), 2011 IEEE, vol., no., pp.1-5, 5-8 Sept. 2011
- Le Roux, Y.-M.; Menard, J.; Toquin, C.; Jolivet, J.-P.; Nicolas, F., "Experimental measurements of propagation characteristics for maritime radio links," Intelligent Transport Systems Telecommunications, (ITST), 2009 9th International Conference, vol., no., pp.364-369, 20-22 Oct. 2009
- EfficienSea Project <http://www.efficiensea.org/>
- MarCom Project <https://sites.google.com/site/marcomcommunity/>
- Bekkadal, F., "Emerging maritime communications technologies," Intelligent Transport Systems Telecommunications, (ITST), 2009 9th International Conference, vol., no., pp.358-363, 20-22 Oct. 2009
- K. Bronk, A. Lipka, R. Niski, Raport: "Measurement campaign at the Baltic Sea", EfficienSea Efficient, Safe and Sustainable Traffic at Sea (EfficienSea), 2012
- NetBaltic Project <http://netbaltic.pl>